FLIGHT & AIRCRAFT ENGINEER

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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EDITORIAL COMMENT.

A CORRESPONDENT of the *Daily Mail* advances a most excellent proposal, to the effect that a Territorial Air Force should be constituted. The correspondent in question, Lieut. F. E. Bussy, late of the R.A.F., points out that there are tens of thousands of highly-skilled and thoroughly efficient flying officers and air mechanics now being demobilised and passing into civil life.

Air "Terriers"

If these men are to be of any use in emergency it is absolutely necessary that they should be kept in practice and familiar with developments in aviation. A flying officer in two or three years will have lost his skill in aerial fighting and bomb-dropping, and he will certainly be unfamiliar with the machines, engines, armaments and instruments which will then be in service. The same applies in equal degree to air mechanics. A month or even a fortnight's training once a year would go very far to enable this valuable material to "keep its hand in" in case of future trouble.

We are in complete agreement with the view expressed in the letter in question. Of course, if there is to be no more war and if the League of Nations is to accomplish all that President Wilson appears to hope of it, there will be no more necessity for keeping our powder dry against emergencies such as Mr. Bussy seems to fear. But we, for our part, have no particular faith in schemes of Utopia, and with the lesson of 1914 fresh before our eyes are most strongly convinced that only in complete preparedness for every eventuality which may arise is there any real guarantee of permanent peace. We do not want armaments for purposes of aggression. That is proved by our record of the past. It would have been perfectly easy, having regard to the preponderating power of our naval armaments, for Great Britain to have pursued a policy of aggression had she been disposed that way, and the fact that, with that power in her hands, she did not is a powerful argument for future trust in her intentions. But if we were well prepared for the sea war, it cannot be pretended that we were ready for a great war on land. We certainly were not, and we believe, as do most others who take the trouble to think even superficially, that had we been as ready on land as we were supposed to be at sea there would have been no war. In spite of every warning from sailors and soldiers, the politicians persisted in their policy of trusting to chance, and the result was that Germany was practically invited to embark upon an aggressive enterprise which, thanks to our unpreparedness, only failed of success by a hair's breadth. The failure to expend a few hundreds of millions on preparation has cost us the lives of a million men and as many thousands of millions as the hundreds which would have sufficed to ensure against war.

The question that has to be answered now is: Are we to go back to the cheese-paring policy which landed us in a war that nearly ended in disaster? Are we to go blindly on, trusting to a fanciful League of Nations to keep the peace for us, or are we to profit by the lessons of the war and take out our own insurance policy against possible disaster? If the latter, then it is clearly the right thing to follow the suggested lines and to see to it that the priceless material which the R.A.F. is now ruthlessly dis-

carding in order to get down to peace establishment, is not permanently lost to the nation.

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Assistance in the Atlantic Flight

Both the Admiralty and the Air Ministry appear to be disposed to give all the assistance possible to aircraft attempting the Atlantic flight. Although there is no word of the former having specially detailed ships to patrol the routes to be taken by competitors for the prize, it has issued a series of instructions to ships employed on the Atlantic trade routes. The full text of this instruction was published in our issue of last week. As a document it is really of historic interest, forming as it does one of the "Milestones" of flight, in that it is the first "instruction" of its kind issued publicly to mariners and aviators. There have been such instructions issued to His Majesty's ships during the war, but these have necessarily been of a Service, and, therefore, secret and confidential, nature. This one, however, is a different matter entirely, and marks the beginning of a series of instructions on the lines of the familiar "Notices to Mariners" issued by the Board of Trade and Trinity House, many of which will in the future apply in whole or part to the navigators of aircraft following the sea lanes and using the narrow waters of the British coasts.

In addition to this, the Air Ministry has published a series of "Notes on the Transatlantic Flight," explaining the nature of the assistance that is being given by the Government in order to protect competitors and particularly to ensure the success of a British craft. An officer of the R.A.F. has been placed at the disposal of the Royal Aero Club to act as official starter at St. John's, while every possible arrangement has been made to transmit to competing aircraft by wireless the latest meteorological information. In a word, we are thoroughly satisfied that, after a period of doubt, the Admiralty and the Air Ministry have jointly and severally thrown themselves whole-heartedly into the enterprise of endeavouring to make certain that the first Atlantic crossing shall be made by a British machine, and that, as far as human precaution can avoid disaster, the flight shall be made in safety. There remains now nothing to be said but that we wish all success to the British entrants, and may the best man and the best machine achieve the distinction of being first to cross.

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Codifying the Laws of the Air

The technical sub-committee of the International Aerial Commission, which is sitting in Paris as a part of the Peace Conference, has apparently agreed upon a code of rules to govern commercial and private flying. Its decisions are formulated in a report which has already been considered by the Commission, and will probably be embodied as they stand in the International Convention which will shortly be concluded. They deal with the following matters:—(*a*) Marking of aircraft, (*b*) certificates of airworthiness, (*c*) log-books, (*d*) rules as to signals, rules of the air, and regulations for air traffic on and in the vicinity of aerodromes.

Regarding the marking of aircraft, the sub-committee have recommended a system of marking by capital letters, of which the first letter will represent the national mark of the country, and will be followed by a group of four capital letters, pronounceable if possible, each group containing at least one vowel. We confess we scarcely follow the idea, which is likely, we imagine, to lead to a good deal of mistaken identification unless a lot of care is exercised in the allocation of these four-letter words. We confess to a prejudice in favour of numbers, though it must be admitted at the same time that it is possible that, when the complete scheme is known, the lettering device may after all prove the simpler, though at first sight it does not emerge that it is likely to be so.

For the interchange of wireless communications a call sign of a group of five letters is to be used in making or receiving messages. Here, again, it might have been thought that, as the lettering system of identification has been adopted, identification signals should be restricted to the letters employed in the name, or, more correctly, the letter-number of the machine. It may be that this is the intention, and that the call signal will consist of the national prefix letter, followed by the specific identification letters, but that is not apparent from the wording of so much of the report as has been published.

Coming to the matter of certificates of air-worthiness, the main conditions governing these include approval of design, flying trials of the first of the type, approval of workmanship and materials, and equipment with suitable instruments. These are admirable, since they are the minimum required to safeguard the public and the maximum which can be insisted upon without causing undue trouble and vexation to constructors and flying service enterprises. Naturally a good deal will depend upon the methods of administration adopted in the various countries, but that is a matter which must be left to settle itself in the future.

The suggestions for rules of the air are the essence of simplicity, and are based almost entirely upon the rules of the road at sea. These have stood the test of many years of use, and it would be difficult to see how they could be improved upon for use in aerial navigation. The regulations for air traffic on and in the vicinity of aerodromes and landing grounds are, necessarily, not quite as simple. Aerodromes are to be of standard design, and will be divided into three "zones," viz., a landing zone, a neutral zone, and a departure zone. The boundaries of the three zones will be indicated during daylight by white strips and by night by ground lights. When the wind shifts the line of the marks will be altered so that machines can always land and take off into the wind. The rules will be:—

(1) Land on the left.
(2) Start from the right.
(3) Right-hand machine has precedence in starting.
(4) Immediately after landing, "taxi" straight off the landing zone into the neutral zone.
(5) When red flag is flying on aerodrome circle to right as you descend to land. When blue flag is flying circle to left.
(6) After taking off it is forbidden to turn till 500 yards have been flown in straight line, to prevent collisions.
(7) No "stunting" whatever within 1,000 yards of the edge of aerodromes or at a lower height than 6,000 ft. above them.

The qualification of pilots has apparently been

Flight—And the Men

MR. G. HOLT THOMAS, one of the earliest Commercial Aviation Pioneers, Founder (1911), Chairman and Managing Director of the Aircraft Manufacturing Co., which constitutes, with its associate Companies, a vast aircraft enterprise

discussed by the sub-committee, and a certain minimum international standard will be insisted upon, but the details of this do not appear to have been worked out, nor are any suggestions made as to the proper authority to make the necessary tests and grant certificates. The idea of our own Government is to have a series of classes of pilots, and it is hoped to make the "British Pilots' Certificate A" the leading diploma of the world. It will involve severe trials in night flying, aerial navigation, and every branch of flying accomplishment, and those who achieve the honour of its possession will be able to claim that they are the world's crack aviators. We shall await with more than ordinary interest the issue of the complete text of this part of the Convention when it has been finally agreed by the International Commission.

The Scandal of Adastral House

Our readers will doubtless recollect that at the time when the Government refused to pay rent for De Keyser's Hotel, which was first commandeered for the accommodation of the R.F.C., and renamed Adastral House, we wrote in unmeasured terms of the iniquity of pleading privilege of the Crown and refusing all recompense to its owners. The case was taken to the Courts, and in the King's Bench it was held by Mr. Justice Peterson that the Crown was not legally liable to pay compensation, and that any payment made in a case of the kind need only be *ex gratia*. The Company appealed, and, we are glad to say, obtained a reversal of the decision of the lower court by a majority of the sitting judges.

The Master of the Rolls, in the course of his judgment, said that the case raised a question of great public importance, viz., whether the Crown was entitled as of right to use and occupy any lands, buildings and premises for administrative purposes in connection with the defence of the realm for an indefinite period without any obligation to make compensation for such occupation. For the hotel company it had been argued that although it might have been necessary for the administration of affairs for the safety and security of the realm that the Government should occupy the premises, there was not and never was any necessity for the safety of the realm to refuse to pay for occupation. The hotel company further insisted that the Government were bound by statute to pay. Continuing his judgment, the Master of the Rolls said that these premises were used throughout the whole period for administrative purposes, for which they were considered suitable, having regard to the large number of rooms, lighting and so on. For the Government, the Attorney-General had argued that no compensation was payable by law to the company. His Lordship then referred to searches which had been made at the Record Office, and said that the result of them was that it did not appear that the Crown had ever taken the subjects' lands for the purposes of the defence of the realm without paying compensation. He could not accede the right of the Crown to any such prerogative. Having referred to the emergency legislation passed in August, 1914, and the regulations and Orders in Council made thereunder, the Master of the Rolls said no power thereby was conferred on the Crown to take the land of the subject without payment. He was of opinion that the judgment appealed from was erroneous, and that judgment should be entered for the company for a declaration that they were entitled to a fair rent for the use and occupation by way of compensation under the Defence Act, 1842. One judge only, Lord Justice Duke, dissented, and, as we have already recorded, judgment was given for the company with costs.

Whether the Government will take the case to the House of Lords remains to be seen, but, whatever action is taken and whatever the result in the end, it cannot be argued that the decision of the Court of Appeal is otherwise than in accordance with true justice and equity. It may not agree with the most pedantic interpretation of statute law, but that is another matter altogether. The way the case appeals to us is that it is one in which it was attempted by the Crown to make the individual shoulder a burden which by rights belonged to the whole community. Why there was ever any dispute about the liability to pay an equitable rent for the premises passes comprehension, unless it was an attempt by the Crown to establish its right to take over any buildings and land whatsoever, without payment, and then to refuse compensation to all whose buildings and lands have been commandeered for the purposes of the war. To our way of thinking, the whole case was a particularly bad example of sharp practice on the part of the advisers of the Crown, and it must be a matter of sincere satisfaction to the individual citizen to have it established that his rights are inviolable.

Civilian Flying at Easter

THE Air Ministry makes the following announcement :—

"It is intended that civil aviation shall commence, under regulations shortly to be issued, on May 1. Applications have been received from various companies for permission to carry civilian passengers for short flights during the Easter holidays in anticipation of the issue of the regulations. It has been decided to give permission for this between the dates of April 17 and 22 inclusive. The flights must be made from an approved aerodrome, subject to an undertaking being given that the rules of the aerodrome will be strictly observed, and will be limited to a radius of three miles from the aerodrome. Service-type machines, which have been built under the supervision of the Aircraft Inspection Department, will alone be used."

Applications for permission to carry out such flights should be submitted, addressed to the Secretary, Air Ministry, marked Controller-General of Civil Aviation, and should contain the following particulars :—

(*a*) Type of machine, with sufficient particulars to identify it.

(*b*) Full name and surname of the pilot.

(*c*) Location of the aerodrome and of the aircraft proposed to be used.

(*d*) Name of the company or firm making the application.

Flying to the House

ON April 9 General Seely gave another practical demonstration of the utility of aircraft by flying to the House of Commons from Rochester where he had been visiting Messrs. Short Brothers' works. Leaving Rochester at 4 p.m., General Seely, accompanied by Major Sippe, flew up the river on a Sunbeam-engined Short seaplane piloted by Mr. J. Lankester Parker, and alighted on the Thames off the Houses of Parliament at 4.23 p.m. General Seely was taken off by a motor launch, landed at Westminster Pier and immediately went to the Commons.

(*From an original drawing by Roderic Hill*)

"THE FOOD-CARRIERS."—Three D.H. 9's with Siddeley "Puma" engines returning from a trip to Belgium

THE B.A.T. FOUR-SEATER BIPLANE

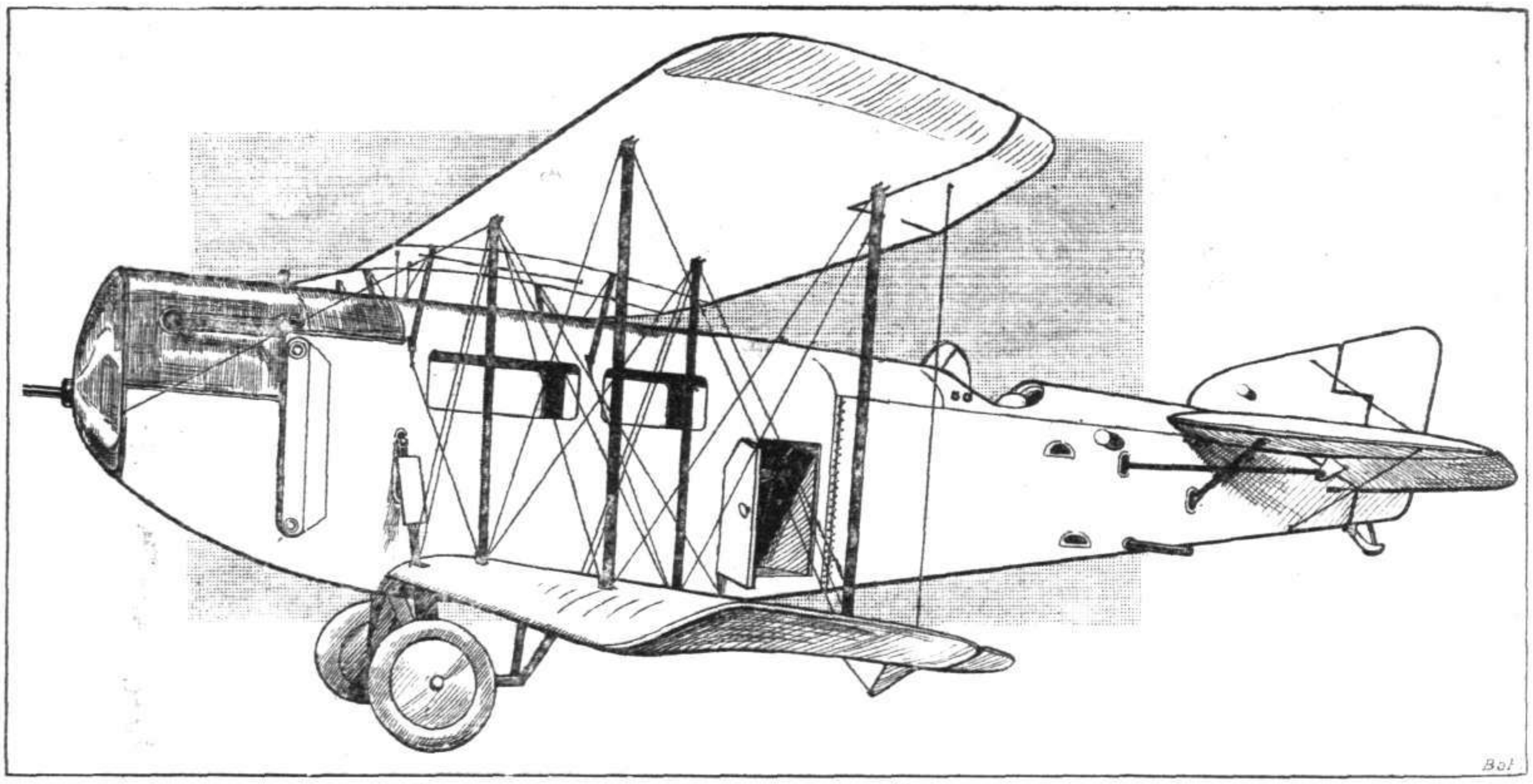
ONE of the first, if not *the* first, post-War "commercial" aeroplanes has just been completed by the British Aerial Transport Co., Ltd., at their works at Willesden. By post-War commercial aeroplane, we mean a machine that has been designed since the Armistice, specially for commercial work —either passenger, mail or goods—and *not* a war machine converted for this purpose. In this particular case, the B.A.T. F.K. 26 has been designed either for passenger work or for carrying mails, there being accommodation for four passengers, besides the pilot in the former case, whilst for the latter purpose it is merely a question of adapting the passenger cabin to meet the requirements for this kind of work. Mr. Frederick Koolhoven, the designer of this machine, is to be congratulated on having succeeded in producing a machine that is original in many respects, but is at the same time of absolutely straightforward design, free from "cranky" features.

F.K. 26 is a single-engined tractor biplane, and as may be seen from the accompanying scale drawings, the general lay-out of the "weight items" is efficient and well thought out. The position of the pilot, well aft of the main planes, is such that it enables him to have an excellent view in all directions.

The *fuselage*, which is 30 ft. 10 in. in length, is of rectangular section, very deep near the wings and tapering to a vertical knife-edge at the rear. Two different forms of construction are employed in the *fuselage*, the front half, from the nose to the end of the passenger cabin, being built up of three-ply and formers in a similar manner to that obtaining in the German Albatross machines, whilst the rear half is of the conventional girder construction. Both systems, however, have many interesting features. There are four main *longerons*, of about 1¼ by 1¼ in. L-section (solid where necessary), running from end to end, and one additional *longeron* of similar section in the front half situated between the upper and lower *longerons* on each side, level with the line of thrust. These *longerons* are of ash in front and spruce in rear portions. In all there are five transverse formers in the front half of the *fuselage*, built up mainly of H-section members reinforced by three-ply, and varying in shape and structure as shown in one of the accompanying diagrams. There are also diagonal H-section struts between each former, on the sides of the *fuselage*, and an outer covering of three-ply tacked to the formers and struts completes the construction. There is no wire bracing whatever in this portion of the *fuselage*. The first and second formers carry the strong ash engine bearers, the third and fourth are placed in line with the front and rear wing spars respectively—the fourth former being in the centre of the passenger's cabin is, therefore, left open, *i.e.*, it has no cross members except at the top and bottom. The fifth former serves as the end wall of the cabin, and between this and the fourth former is what might be termed a false former of light construction. The engine and fuel compartments have a single outer covering of three-ply, whilst the cabin portion has a double (inner and outer) covering. Three separate compartments or bulkheads are thus formed, the first being the "engine room," the second housing the large fuel tanks (six hours), and the third the passenger's cabin.

The latter is exceptionally roomy, measuring roughly, 3 ft. in width, 8 ft. in length, and just over 5 ft. in height. For passenger work, therefore, it affords great possibilities in the way of a luxuriously fitted-up and comfortable "saloon," with armchairs, tables, etc. In the present model there will be three armchairs and one folding seat, the latter being opposite the door, which is at the rear of the cabin on the port side. Windows, with sliding Triplex glass, are cut in the sides of the cabin between the top and middle *longerons*, three on the starboard, and two on the port sides, whilst portholes will also be let into the turtle-deck roof at various points.

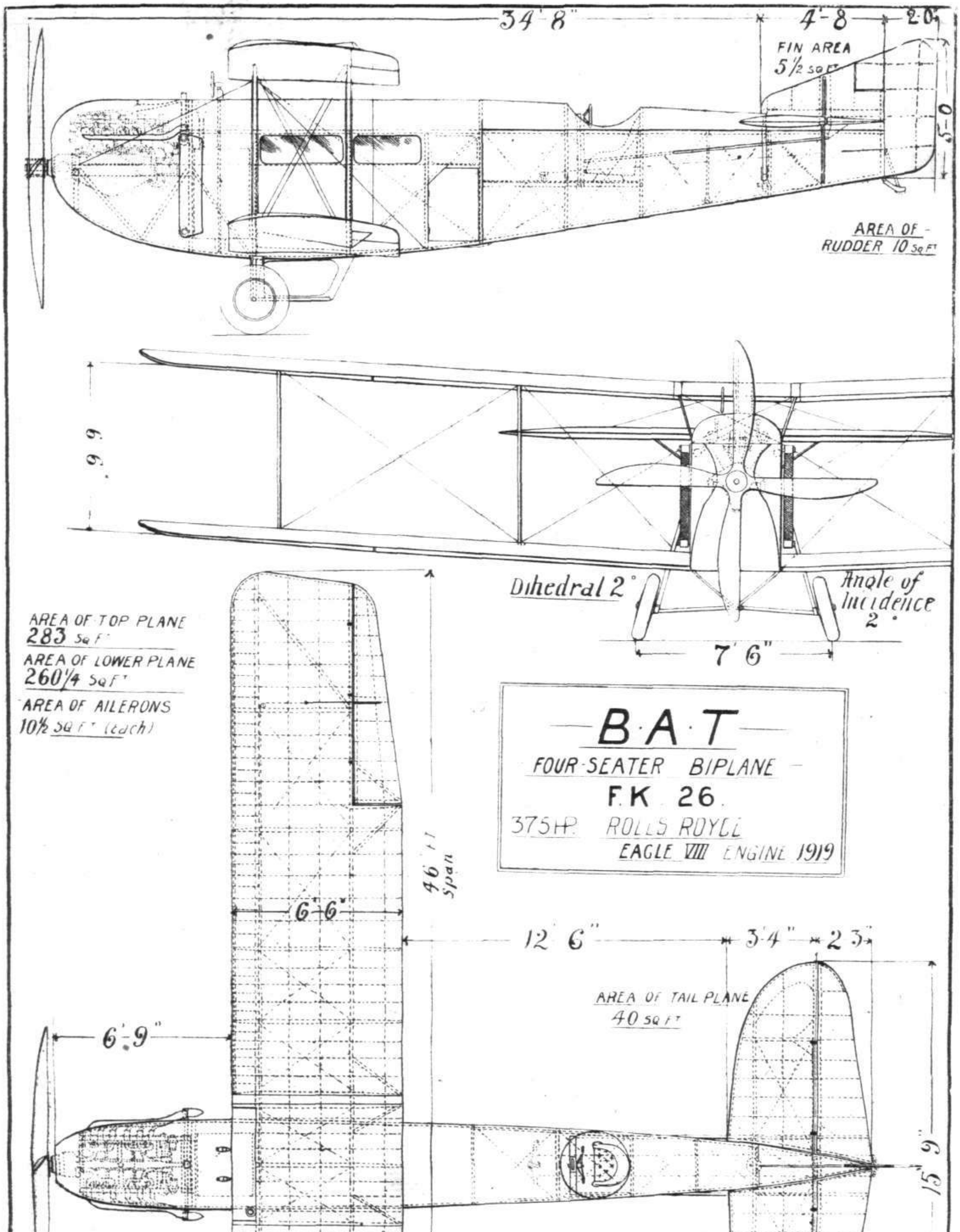
The cabin is equally suitable for mail work, and one can easily visualise this roomy compartment fitted up with pigeon-holes and benches, with a P.O. clerk busy at work sorting out letters, depositing them in their respective parachute bags, and dropping them overboard above their destination!



A three-quarter front view of the B.A.T. four-seater biplane

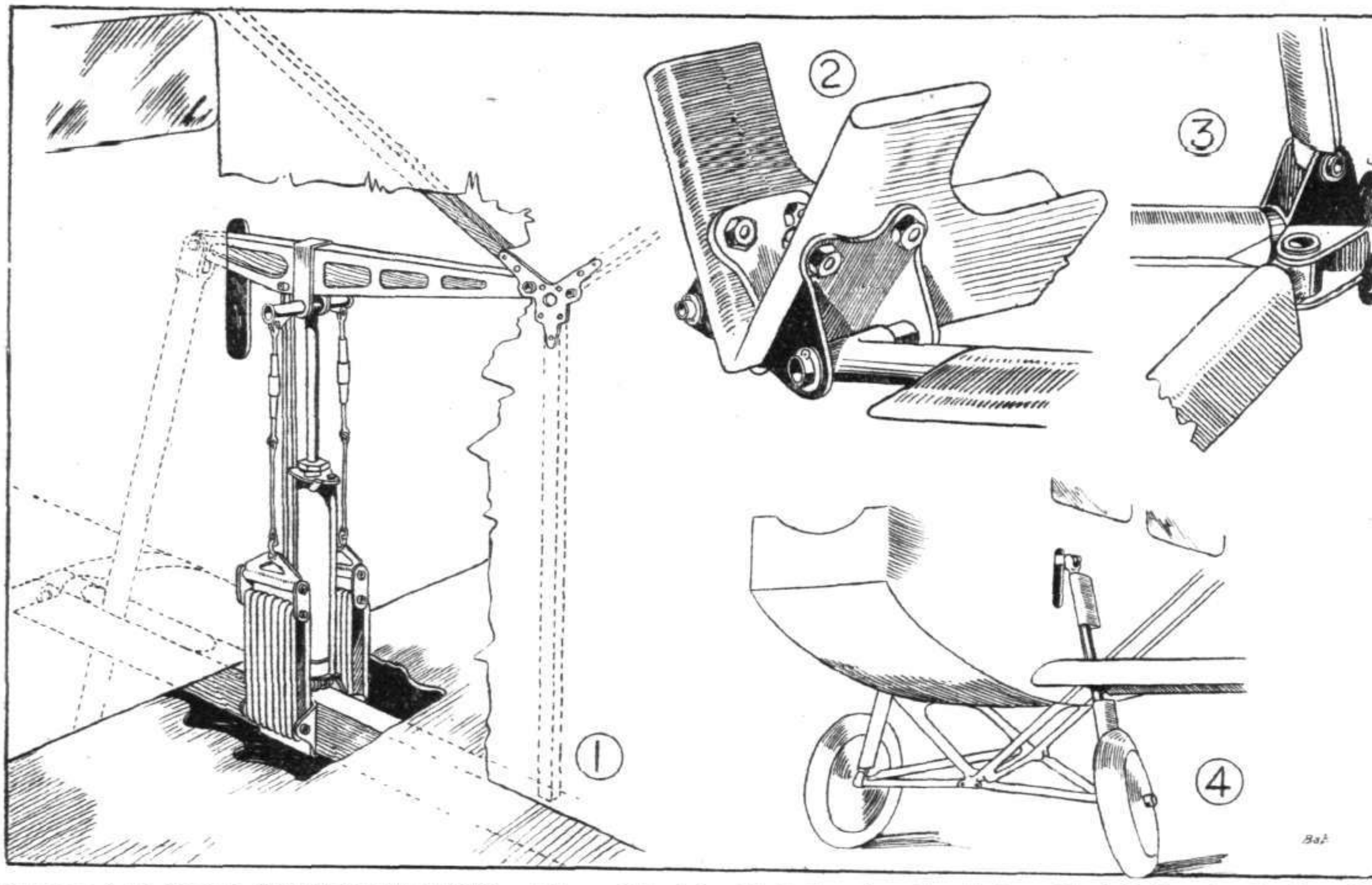
Aft of the cabin the *fuselage* is a girder of six bays, the first set of cross members being built up on the lines of the formers in the front half, as shown by No. 6 in the accompanying diagram. The other cross members are of the usual H-section, reinforced here and there by three-ply. With the exception of the last one, all the bays are braced with flat "streamline" steel cable; the last bay, however, has H-section diagonal struts and a three-ply covering. The pilot and control are located in the second bay, being supported fairly high up in the *fuselage* by two channel-section bearers on a three-ply floor. This rear portion of the *fuselage* is covered with fabric, except for the top, which has a three-ply turtle-deck. At the end of the third bay a steel tube passes across the *fuselage* through the lower ends of the vertical struts and projects a few inches on either side of the *fuselage*, thus providing a means for lifting the tail.

The control is similar to the well-known "Dep." type, and consists of a wooden ∩-bridge pivoted to the previously mentioned bearers, carrying at its upper end the peculiar shaped "wheel" shown in one of the accompanying sketches. The elevators are operated positively by flat elliptical-section steel tubes, anchored at the forward ends to each side member of the bridge and connected at the rear to a strong single crank arm on the underside of each elevator flap. The *aileron* cables are led from the "wheel" over pulleys down the arms of the bridge to its base, whence they pass down to pulleys at the end of the cabin, just below the floor, under which they proceed to pulleys at a point just behind the front spar, where they are taken at right angles out of



THE B.A.T. FOUR-SEATER BIPLANE, F.K. 26.—Plan, side and front elevations to scale

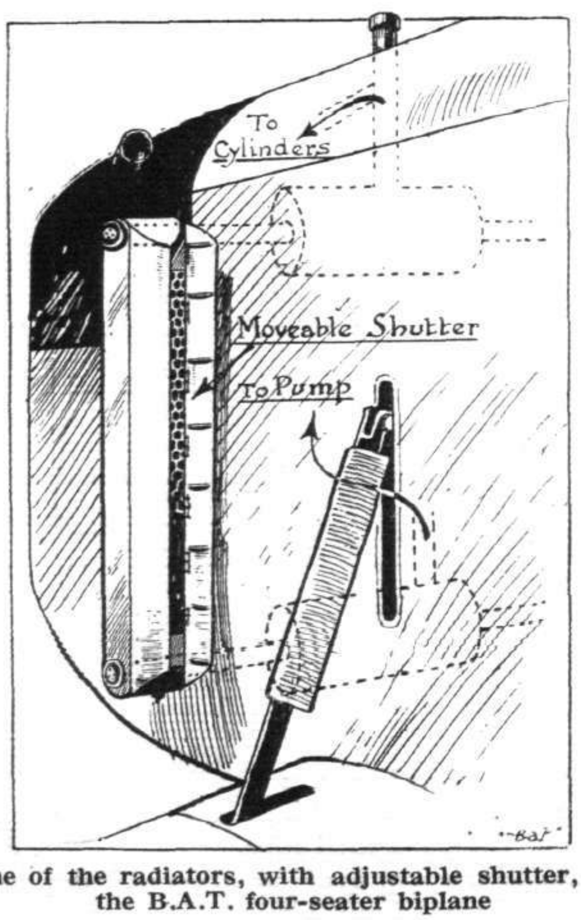
the *fuselage* through the lower plane to pulleys just beyond the outer interplane struts. From here they pass out underneath the plane to cranks on the underside of the *ailerons*. The upper and lower *ailerons* are connected by steel cables, and rudder cables, all other control connections (engine, etc.), are steel or aluminium tubing—all shafts or cranks being mounted in ball bearings. The engine control rods (aluminium) pass out from the cockpit through the turtle deck



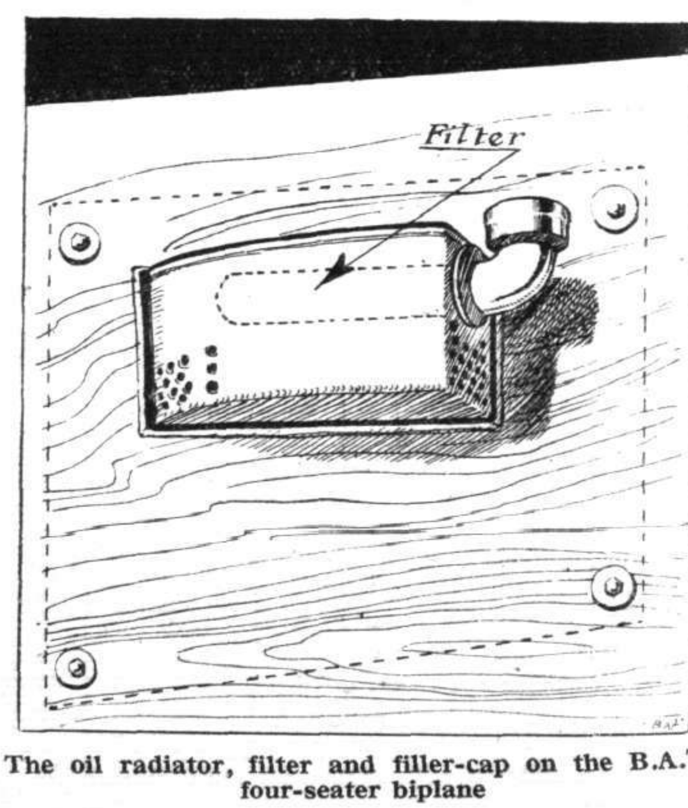
THE B.A.T. FOUR-SEATER BIPLANE.—The original landing chassis, showing on the left the shock-absorbing gear, and on the right, the hinged stub axles and hub at the top, and below, a general view of the chassis

and the upper port and starboard *ailerons* are connected by a balance cable passing along inside the top plane. The rudder is operated direct by cables from a wooden foot-bar reinforced by sheet aluminium. Except for the *aileron* and pass along on top of the latter to the "engine room." The switches are mounted outside the cockpit on the port side of the turtle-deck.

The angle of incidence of the tail plane can be adjusted whilst in flight by means of an aluminium wheel, at the pilot's left just below the seat, which operates through cables a screw and nut gear as shown in one of the accompanying sketches. The rear spar of the tail



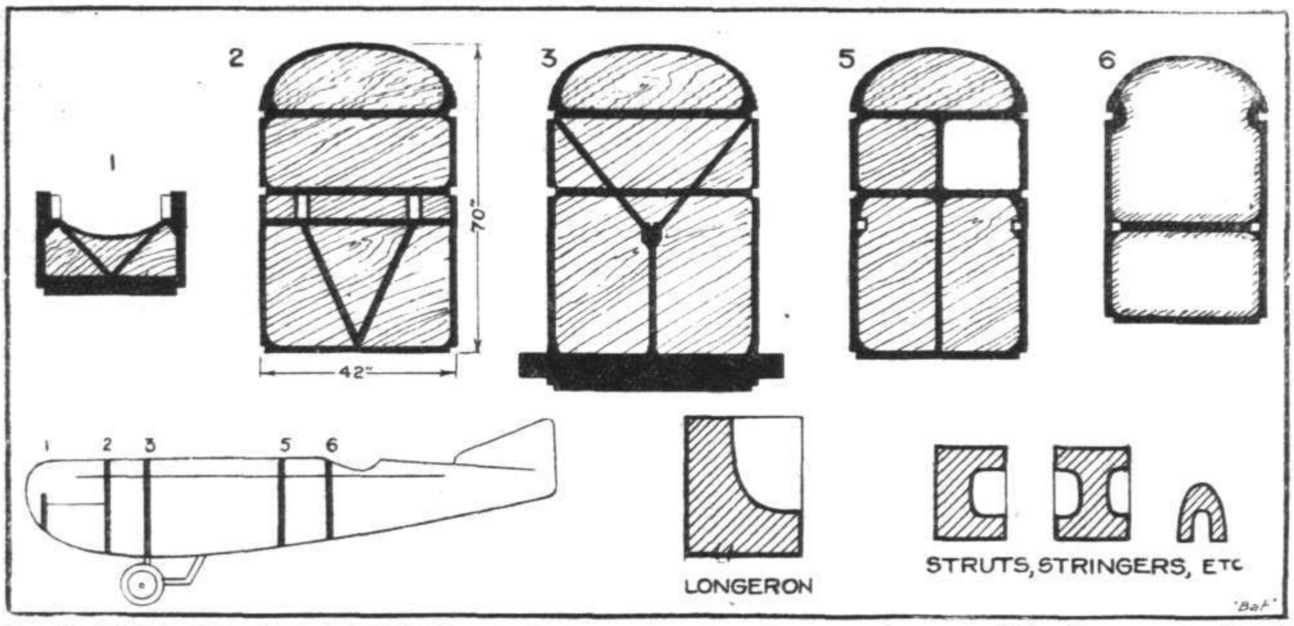
One of the radiators, with adjustable shutter, on the B.A.T. four-seater biplane



The oil radiator, filter and filler-cap on the B.A.T. four-seater biplane

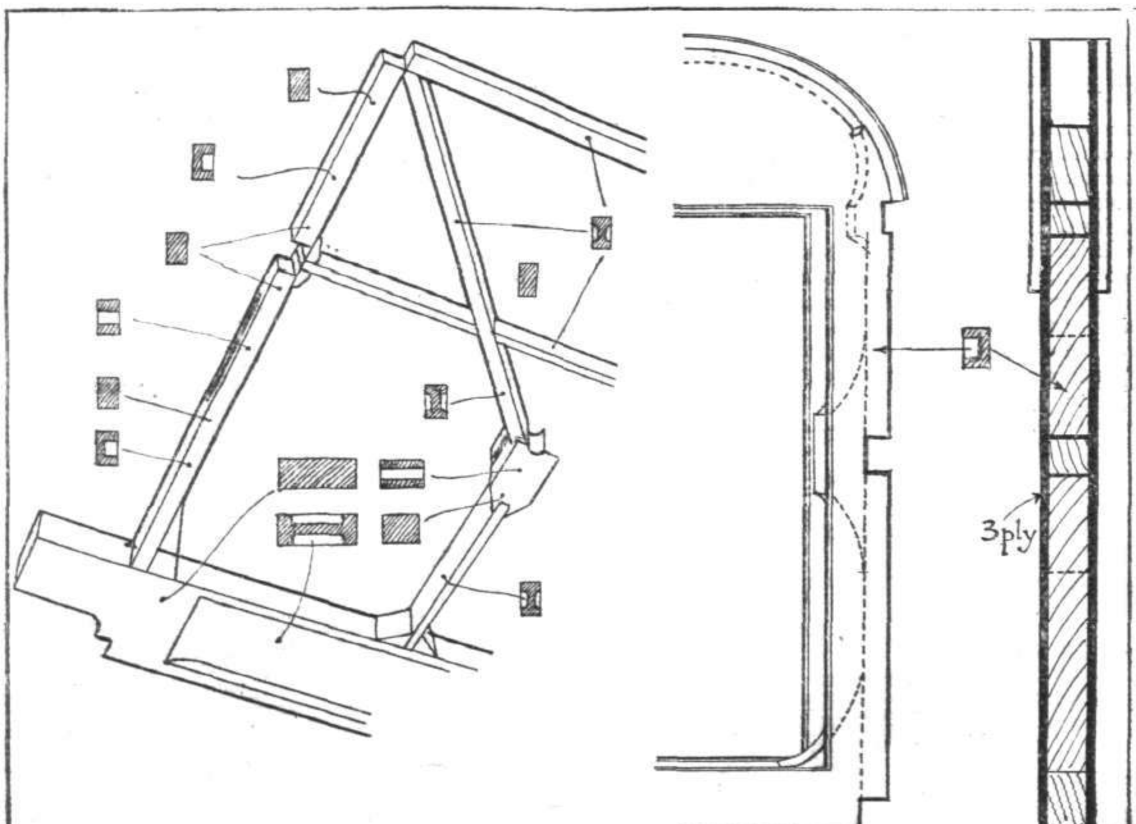
plane is hinged, so that the front of the tail is raised or lowered.

The main planes are of equal span, and are made of four interchangeable sections and a centre section to which the upper planes are attached. The centre section is mounted on two pairs of steel struts sloping outwards from formers three and four. Each pair of struts is laterally cross-braced



THE B.A.T. FOUR-SEATER BIPLANE.—A diagram showing the arrangement of the formers in the fuselage

by flat, oval section steel wires. A steel strip also connects the lower ends of the port and starboard struts and takes some of the load from the landing wires which are taken from the base of the centre section struts to the lower plane. The lower plane is attached to short centre sections projecting from the sides of the *fuselage*, giving the same overall width as the top centre section. The centre section spars pass



The B.A.T. Four-Seater Biplane.—Some constructional details of formers 3 and 4 on the fuselage

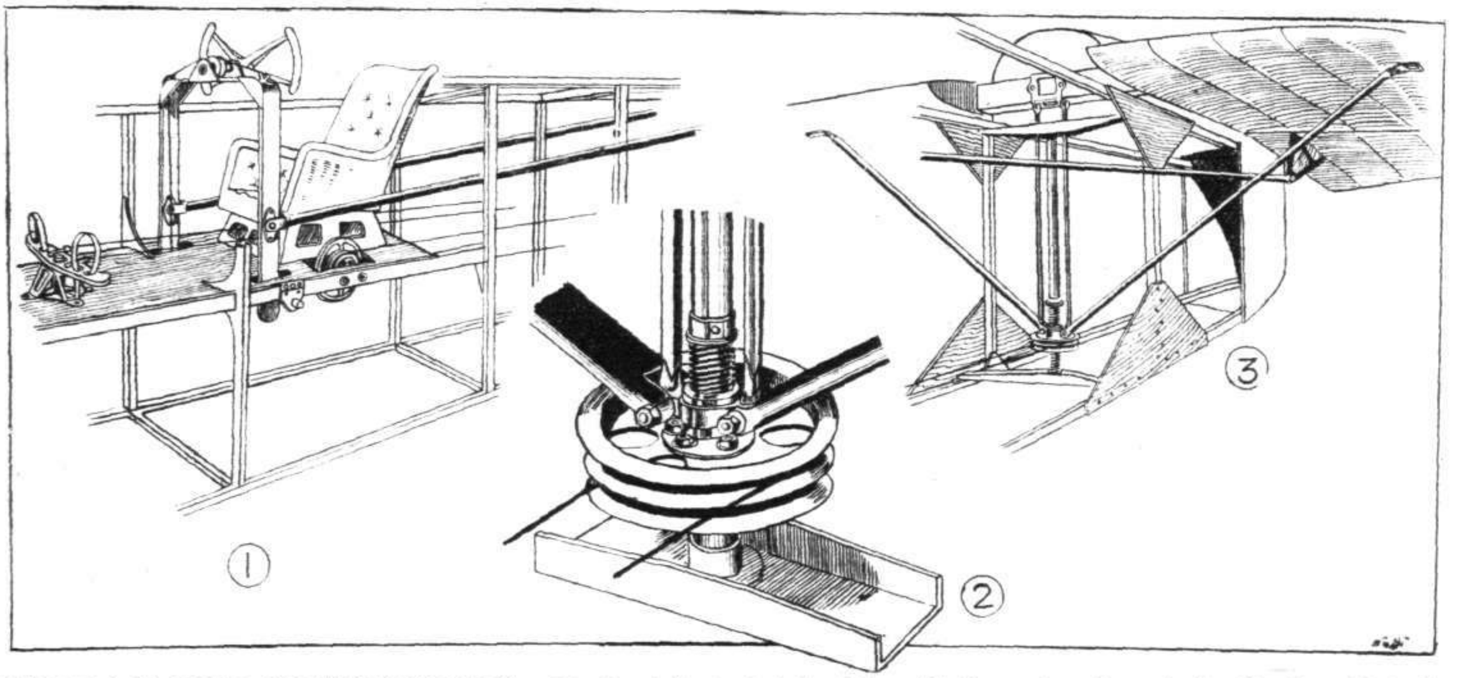
through the *fuselage* and are built integral with the respective former. In the front one the ends are cut short for the passage of the chassis strut, which passes through a welded steel box which replaces the cut away portion of the spar. The end of this box also forms the wing attachment fitting which is the same on all spars, and which is shown in one of the illustrations. Constructionally, the planes present nothing unusual, except, perhaps, in the tips. They have what might be described as a lateral washout, that is, the under surface curves up to meet the top surface which is level right to the tip. The spars of laminated I-section, solid where necessary, and the ribs are built up as usual of spruce webs and flanges. Each wing has four bays, the compression members being of the box type, and located at the inter-plane struts with a third in between. The internal bracing is of piano wire, the outer bay having a diagonal strut. Top and bottom planes are separated by two pairs of tubular steel struts aside, and the whole of the external bracing is by streamline wire. *Ailerons* are fitted to both top and bottom planes, and these taper from root to tip.

The tail plane is of high aspect ratio, and has a symmetrical streamline section. It is built in one piece and mounted just above the top *longerons*. The rudder is balanced, the vertical fin being cut away to receive the balanced portion. By far and away the most interesting feature of the F.K 26 is the landing chassis and its shock-absorbing arrangement. As may be seen from our illustrations, the wheels are each hinged by two stub axles to a cabane, consisting of a pair

of V struts connected by a longitudinal member, mounted on the bottom of the *fuselage*. The front pair of these stub axles lies at right angles to longitudinal axis of the machine, and the other pair is inclined back to the rear V of the *cabane*. Extending upwards from each outer extremity of this "axle-Vee" is a steel tube which is connected at its upper extremity to the end of a lever projecting through the sides of the *fuselage* and hinged at its other end to the centre of the *fuselage*-former. Near the outer extremity of this lever is a lug from which connection is made to an oleo shock-absorber and to a pair of ordinary elastic shock-absorbers. There is a similar gear on each side of the *fuselage*. Thus, on landing, as the wheels rise, they also lift the levers against the action, first, of the oleo, and then of the elastic absorbers. and containing a steel spring, which absorbs the shocks on striking the ground.

The engine is a Rolls-Royce Eagle VIII, mounted, as previously stated, on two strong ash bearers between the first and second formers. It is enclosed by an aluminium bonnet, whilst a "manhole" in the bottom of the *fuselage* gives access to the engine from underneath.

The cooling system is very efficiently carried out, and is made up of two long streamline-shaped "honeycomb" radiators, mounted one on each side of the *fuselage*. They are connected top and bottom to two tanks within the *fuselage*, as indicated in one of the accompanying sketches. On the back of each radiator is a shutter, which can be opened or closed from the pilot's cockpit. A neat and simple

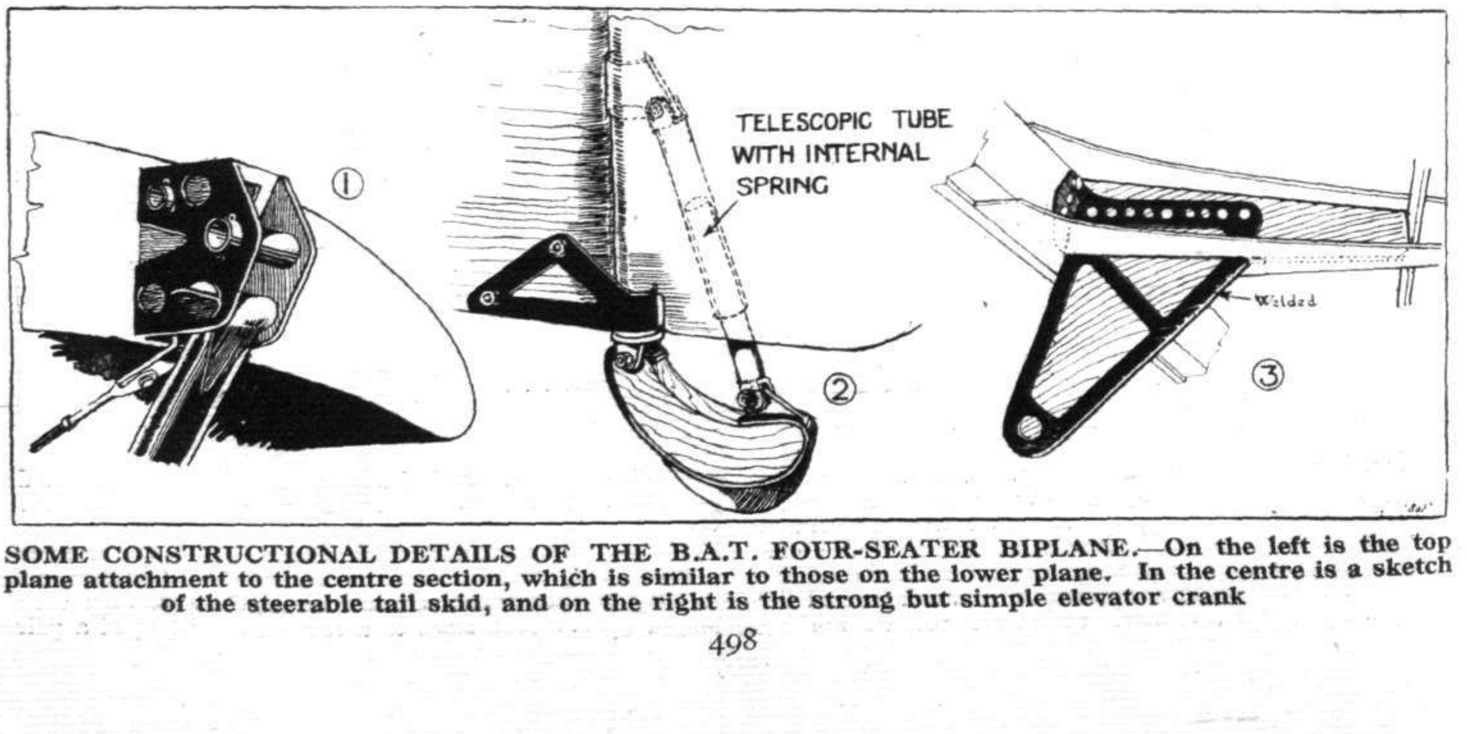


THE B.A.T. FOUR-SEATER BIPLANE.—On the left, a sketch of the pilot's seat and control. On the right, the tail plane trimming gear, and inset, a detail of the screw-gear of the latter

The levers above referred to are of welded steel box construction, and it will be noticed that the wheels are splayed, so that when in flight they point inwards in a down direction, and when on the point of landing they are more or less horizontal, and when the machine is at rest, with its full weight on the wheels, they point inwards in an up direction. The general arrangement and construction of this landing gear is clearly shown in our illustrations.

Another interesting feature is in the tail skid. This is of the steerable type, and consists of a short steel-shod wooden skid anchored at its upper end to a tube passing up through, and secured to, the rudder post. The "head" of the skid is connected to a lug some distance up the rudder post by two telescopic tubes passing up through the rudder, oil-cooling radiator is also fitted; this is shown in one of our sketches, and consists of an extension of the oil tank next to the engine projecting through the starboard side of the *fuselage*, and having a series of tubes passing through it from front to rear. This projection also carries the oil filter and filling-cup. As previously mentioned, the fuel tanks are located in the compartment between the engine and the cabin. Petrol is delivered direct from the main tank to the carburettor through the agency of two windmill pumps mounted above the turtle deck and the tanks. There is, however, a small service tank, for emergency, let into the leading edge of the top centre section.

The estimated maximum speed of the B.A.T. F.K. 26 is 110 m.p.h., whilst the landing speed is about 40 m.p.h.



SOME CONSTRUCTIONAL DETAILS OF THE B.A.T. FOUR-SEATER BIPLANE.—On the left is the top plane attachment to the centre section, which is similar to those on the lower plane. In the centre is a sketch of the steerable tail skid, and on the right is the strong but simple elevator crank

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

"DAILY MAIL" £10,000 TRANS-ATLANTIC FLIGHT

The following is the list of entries for the *Daily Mail* £10,000 Trans-Atlantic Flight

Whitehead Aircraft (1917), Ltd.: Biplane; 1,600 h.p. Liberty engine. Pilot, Capt. A. Payze.

Capt. Hugo Sundstedt: Biplane; Liberty engines. Pilot, Capt. Hugo Sundstedt.

Sopwith Aviation Co., Ltd.: Biplane; 320 h.p. Rolls-Royce Eagle engine. Pilot, Mr. H. G. Hawker.

Short Bros.: Biplane; 350 h.p. Rolls-Royce Eagle 8 engine. Pilot, Maj. J. C. P. Wood.

Fairey Aviation Co., Ltd.: Biplane; 360 h.p. Rolls-Royce engine. Pilot, Mr. Sydney Pickles.

Martinsyde, Ltd.; Biplane: 285 h.p. Rolls-Royce Falcon engine. Pilot, Mr. F. P. Raynham.

Handley Page, Ltd.: Biplane; 4 350 h.p. Rolls-Royce Eagle 8 engines. Pilot, not yet nominated.

Boulton and Paul, Ltd.: Biplane; 2 450 h.p. Napier Lion engines. Pilot, not yet nominated.

THE FLYING SERVICES FUND

(Registered under the War Charities Act, 1916)

Administered by the Royal Aero Club

For the benefit of *Officers, Non-Commissioned Officers and Men* of the ROYAL AIR FORCE who are incapacitated while on duty, and for the widows and dependants of those who are killed or die from injuries or illness contracted while on duty.

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Secretary:
H. E. PERRIN

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Subscriptions	£	s.	d.
Total subscriptions received to April 8, 1919..	14,935	5	5
Balance from Comforts Fund, Sick Quarters, No. 7, O.S.A., Royal Air Force, Bath ..		5 15	8
Total, April 15, 1919	14,941	1	1

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

AVIATION AND THE WAR

IN his final dispatch, published in the *London Gazette* last week, Sir Douglas Haig, in reviewing the lessons of the War says:—

A remarkable feature of the present War has been the number and variety of mechanical contrivances to which it has given birth or has brought to a higher state of perfection.

Besides the great increase in mobility made possible by the development of motor transport, heavy artillery, trench mortars, machine guns, aeroplanes, tanks, gas and barbed wire have in their several spheres of action played very prominent parts in operations, and as a whole have given a greater driving power to war. The belligerent possessing a preponderance of such mechanical contrivances has found himself in a very favourable position as compared with his less well provided opponent. The general superiority of the Allies in this direction during the concluding stages of the recent struggle undoubtedly contributed powerfully to their success. In this respect the Army owes a great debt to science and to the distinguished scientific men who placed their learning and skill at the disposal of their country.

It should never be forgotten, however, that weapons of this character are incapable of effective independent action. They do not in themselves possess the power to obtain a decision, their real function being to assist the infantry to get to grips with their opponents. To place in them a reliance out of proportion to their real ability, to imagine, for example, that tanks and aeroplanes can take the place of infantry and artillery, would be to do a disservice to those who have the future of these new weapons most at heart by robbing them of the power to use them to their best effect.

Every mechanical device so far produced is dependent for its most effective use upon the closest possible association with other arms, and in particular with infantry and artillery. Aeroplanes must rely upon infantry to prevent the enemy from overrunning their aerodromes, and, despite their increasing range and versatility of action, are clearly incapable in themselves of bringing about a decision.

Immense as the influence of mechanical devices may be, they cannot by themselves decide a campaign. Their true *rôle* is that of assisting the infantryman, which they have done in a most admirable manner. They cannot replace him. Only by the rifle and bayonet of the infantryman can the decisive victory be won.

Dealing with artillery work, he says:—

The great development of air photography, sound ranging, flash spotting, air-burst ranging and aerial observation brought counter-battery work and harassing fire both by day and night to a high state of perfection. Special progress was made in the art of engaging moving targets with fire controlled by observation from aeroplanes and balloons.

Noticing the work of the Directorate of Army Printing and Stationery Services, Sir Douglas Haig says that in addition to the printing and distribution of orders and instructions, it undertook the reproduction on a vast scale of aerial and other photographs, the number of which grew from 25,000 in 1916 to 2,250,000 in 1918.

In the concluding section of the dispatch, Sir Douglas Haig says:—

I recall with gratitude the magnificent work done during the fighting of 1916 and 1917 by Major-Gen. Sir H. M. Trenchard, at that time commanding the Royal Flying Corps. The influence exerted by this able and distinguished officer upon the *morale* and the development of the British Air Service and in the creation of its splendid traditions can scarcely be exaggerated. Since his transfer to another but kindred field of activity, his work has been most ably and successfully carried on by Major-Gen. Sir J. M. Salmond, commander of the Royal Air Force on the Western front.

◈ ◈ ◈ ◈

Mentioned for Work at Aden

THE names of the following officers of the Royal Air Force have been brought to notice for gallant and distinguished services rendered in connection with the military operations at Aden from August 16, 1917, to January 31, 1918:—

Mann, Lieut. (A. Capt.) L. J., M.C.; Owden, Lieut. J. S.; Stodart, Maj. D. E., D.S.O., D.F.C.

From February 1, 1918, to August 31, 1918:

Knight, Lieut. H. F.; Sherwin, Capt. C. E., M.C.

"The Aeroplane in Industrial Development"

THE second lecture of the series arranged by the Industrial Reconstruction Council will be held in the Saddlers' Hall, Cheapside, E.C. 2, on Wednesday, April 30. The chair will be taken at 4.30 p.m. by the Right Hon. Lord Balfour of Burleigh, K.T., and a lecture on "The Aeroplane in Industrial Development" will be delivered by Mr. Holt Thomas, Applications for tickets should be made to the Secretary. I.R.C., 2 and 4, Tudor Street, E.C. 4.

A New Fuel for Aero Engines

FROM an announcement issued by the United States Bureau of Mines at Washington, it would appear that a new fuel for aircraft work has been evolved. The liquid—which is claimed to add 10 miles an hour to the speed of aeroplanes—is described as a combination of cyclohexane and benzol, called hectar. As it costs about one dollar a gallon it is not regarded as practicable for commercial purposes.

ELEMENTARY NAVIGATION FOR AIRCRAFT PILOTS

By A. W. BROWN

A KNOWLEDGE of at least the elements of navigation is necessary to the pilots of modern aircraft undertaking long journeys, whether over land or ocean. On recognised air-routes over the land, his task will be made easier by the provision of landmarks and lighthouses, but over the ocean, his only guides will be the wireless telegraph, or the sun and stars. Wireless telgraphy provides an efficient and rapid means of locating the positions of an aircraft during a moderately long journey, but its reliability has yet to be proved over greater distances, such as will obtain in the Atlantic flight. On the other hand, observation of the sun or stars provides a reliable and never-failing means of position-finding, for it will be seldom indeed that aircraft will be unable to rise above any clouds obscuring the sky. It is not necessary for the pilot to know every detail of the methods of navigation in use on shipboard; aircraft are in no danger from rocks or shoals, and have a large radius of vision, so that a high degree of accuracy is not essential. At the same time, the great speed of aircraft, and the extent to which they are affected by the wind, render necessary a system of navigation by which the position may be found at frequent intervals with rapidity and a minimum of calculation.

It is the object of these articles to place before pilots an elementary, but practical, method of navigation, leaving it to those interested to study the subject more thoroughly in any of the excellent text-books available. To understand the principles of navigation, a fair knowledge of spherical trigonometry is required, and it has been considered advisable to include also a brief description of the trigonometrical ratios of angles up to 180°, and their application in the solution of plane triangles.

It is assumed that pilots have passed a course in 'plane navigation as taught in the R.A.F. Schools, and that they are therefore familiar with latitude and longitude, the use of bearings and cross-bearings, the Mercator chart, graphical methods of determining course, track, or wind, the magnetic compass, and other instruments used in 'plane navigation.

Trigonometrical Ratios

In any right-angled triangle A B C (Fig. 1), right-angled at C, A, B and C are the angles, and a, b and c are the sides opposite the respective angles.

$$A+B+C = 180^\circ$$
$$C = 90^\circ$$
$$A+B = 90^\circ$$
$A = 90^\circ - B$, hence B is the *complement* of A.
$B = 90^\circ - A$, hence A is the *complement* of B.

$\frac{a}{c}$ is the sine of A (written sin.A) 1

$\frac{b}{c}$ is the cosine of A (written cos.A) 2

$\frac{a}{b}$ is the tangent of A (written tan.A) 3

$\frac{b}{a}$ is the cotangent of A (written cot.A, or ctn.A) 4

Also:

$\frac{b}{c} = \sin.B$ 5

$\frac{a}{c} = \cos.B$ 6

$\frac{b}{a} = \tan.B$ 7

$\frac{a}{b} = \cot.B$ 8

If these are examined, it will be seen that :—

sin.A = cos.B = cos. complement 9
cos.A = sin.B = sin. complement 10
tan.A = cot.B = cot. complement 11

Tables are published giving the values of the above ratios

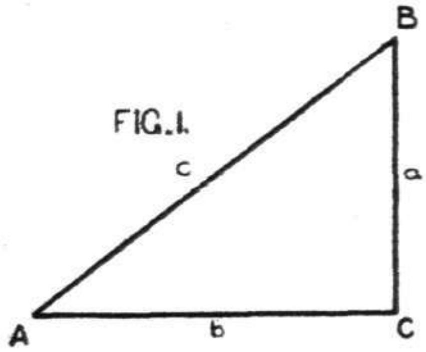


FIG. 1.

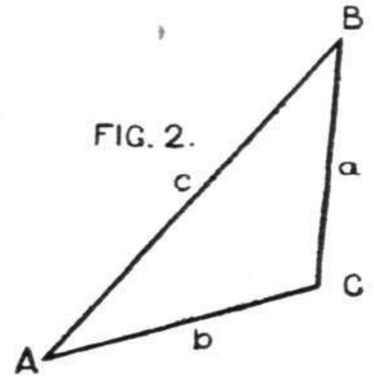


FIG. 2.

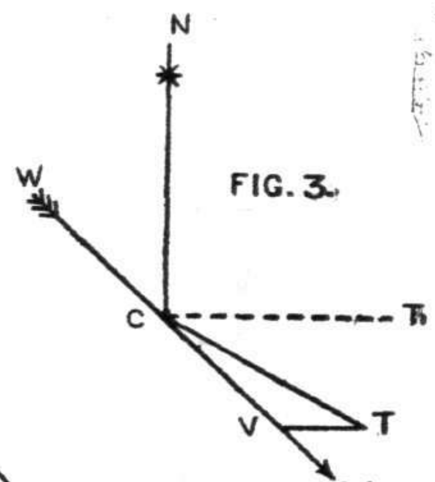


FIG. 3.

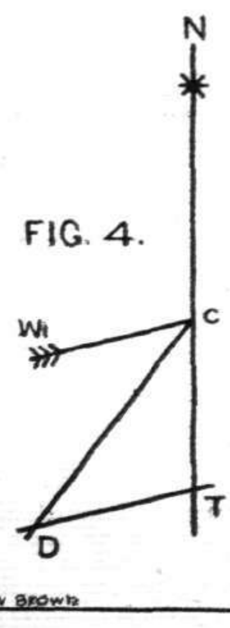


FIG. 4.

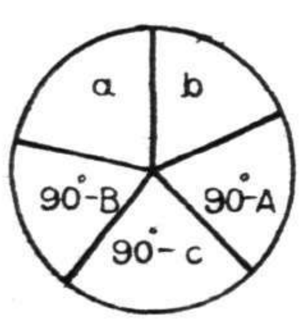


FIG. 6.

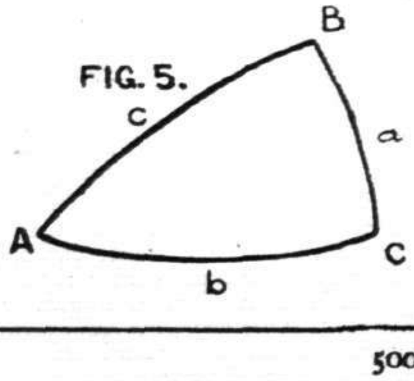


FIG. 5.

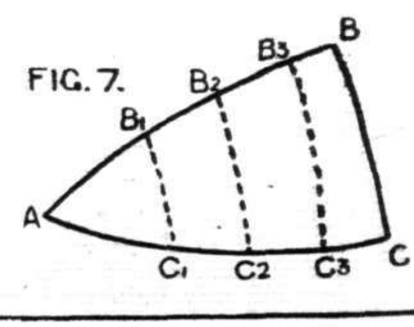


FIG. 7.

A.W. BROWN

for all angles for use in calculations, from which the following short table has been extracted :—

Angle.	Sine.	Cosine.	Tangent.	Cotangent.	
0	.000	1.000	.000		90
5	.087	.996	.087	11.430	85
10	.174	.985	.176	5.671	80
15	.259	.966	.268	3.732	75
20	.342	.940	.364	2.747	70
25	.423	.906	.466	2.145	65
30	.500	.866	.577	1.732	60
35	.574	.819	.700	1.428	55
40	.643	.766	.839	1.192	50
45	.707	.707	1.000	1.000	45
	Cosine.	Sine.	Cotangent.	Tangent.	Angle.

The foregoing ratios are for angles of 90° or less. For angles between 90° and 180°, the ratio of the supplement is used; thus if A is an angle greater than 90°,

$$\text{Sin.A} = \sin(180° - \text{A}).$$

The following must be borne in mind when using the ratios of the supplements : for all angles of 90° or less, all the ratios have positive values, but for angles between 90° and 180°, the sine is positive, and the cosine, tangent and cotangent are all negative.

Example :—

$$\text{Cos } 80° = .174.$$

$$\text{Cos } 100° = \cos(180° - 100°) = -\cos 80° = -.174.$$

In any right-angled triangle, the use of these ratios permits any side or angle to be calculated when only two sides or one side and an angle are known ; thus in Fig. 1, given A 60°, b 40 miles, to find a, c, and B.

B is the complement of A, hence it is $90° - 60° = 30°$.

$$\frac{b}{c} = \frac{40}{c} = \cos 60° = .5 \text{ (from tables).}$$

Therefore $c = 80$ miles.

Also—

$$\frac{b}{a} = \frac{40}{a} = \cot.\ 60° = .577 \text{ (from tables).}$$

Therefore $a = 69.4$ miles (nearly).

In the majority of problems in 'plane navigation, the triangles which have to be solved do not contain a right-angle, and it is then necessary to know either one side and two angles, or two sides and one angle before the remaining sides and angles can be calculated.

In order to solve any 'plane triangle A B C (Fig. 2), either of the following rules may be used according to the data available :—

Rule 1.—Sine Law :

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad 12$$

Rule 2.—Tangent Law. 13

$$\frac{a-b}{a+b} = \frac{\tan\frac{1}{2}(A-B)}{\tan\frac{1}{2}(A+B)}$$

or

$$\frac{b-c}{b+c} = \frac{\tan\frac{1}{2}(B-C)}{\tan\frac{1}{2}(B+C)}$$

$$\frac{a-c}{a+c} = \frac{\tan\frac{1}{2}(A-C)}{\tan\frac{1}{2}(A+C)}$$

Example :—

The desired track is 100° true, wind from 300° true at 20 m.p.h., air speed 100 m.p.h., what is the true course ?

Sketch roughly the diagram, Fig. 3, in which

$$\angle NCT = 100°$$

$$\angle NCW = 300°$$

It follows that

$$\angle NCW_1 = 120°$$

and

$$\angle TCW_1 = 20°$$

CV represents the velocity of the wind, and VT the air speed and course. The line CT_1 is parallel to VT, hence the angle T_1CT equals the angle CTV, and the course is therefore

$$\angle NCT - \angle CTV$$

This is a case for the use of the Sine Law, and by substitution in Eq. 12, we get :—

$$\frac{100}{\sin 20°} = \frac{20}{\sin CTV}$$

$$\sin CTV = \frac{20 \sin 20°}{100} = \frac{20 \times .342}{100} = .0684.$$

From the table it will be found that $\angle CTV$ is less than 5°, being actually 3° 55′, say 4°, and the course will therefore be 100° − 4° = 96° *true*.

With a little practice, this method will be found speedier and much more accurate than the graphical method.

Another Example

An aircraft flies on a course 230° true at an air speed of 90 m.p.h. In one hour the pilot finds that he has travelled 60 miles along a track 180° true, what is the direction and velocity of the wind ?

Sketch roughly the diagram 4, where CT is the track and represents 60 miles. CD is the course, representing also the air speed of 90 m.p.h., therefore DT represents the direction and velocity of the wind. W_1C is parallel to DT, therefore $W_1CD = \angle CDT$, and the direction of the wind will be given by

$$\angle NCD\ (230°) + \angle CDT$$

$$\angle NCT = 180°, \quad \angle NCD = 230°$$

$$\therefore \quad \angle DCT = 230° - 180° = 50°.$$

The sine law cannot be applied in this case, because only one angle is known, and the side opposite to that angle is unknown. It is, therefore, necessary to use the tangent law, Eq. 13, which is applied thus :—

$$\frac{90-60}{90+60} = \frac{\tan\frac{1}{2}(\angle CTD - \angle CDT)}{\tan\frac{1}{2}(\angle CTD + \angle CDT)}$$

Since

$$\angle CTD + \angle CDT + \angle DCT = 180°, \text{ and } \angle DCT = 50°, \text{ then}$$

$$\angle CTD + \angle CDT = 130°$$

$$\tfrac{1}{2}(130°) = 65°$$

hence

$$\frac{30}{150} = \frac{\tan\frac{1}{2}(\angle CTD - \angle CDT)}{\tan 65°}$$

$$\tan\tfrac{1}{2}(\angle CTD - \angle CDT) = \frac{30 \times 2.145}{150} = .429$$

from tables, $\frac{1}{2}(\angle CTD - \angle CDT) = 23° 13'$, say 23°

and $\frac{1}{2}(\angle CTD + \angle CDT) =$ 65°

subtract $\angle CDT =$ 42°

The bearing of the wind is therefore 230° + 42° = 272° *true*.

Another angle of the triangle has now been found, and the sine law may be applied in order to calculate the velocity of the wind.

$$\frac{60}{\sin 42°} = \frac{DT}{\sin 50°}$$

$$DT = \frac{60 \times .760}{.669} = 69 \textit{ m.p.h.} \text{ (nearly).}$$

This second example requires a slightly greater time for its solution than by the graphical method, but is more accurate. The two examples given above are representative of the practical problems which will arise in connection with course-setting during a journey. The usual method of solution by means of the course and distance indicator is sufficiently accurate for all practical purposes, but knowledge and practice of the mathematical method will be beneficial.

Spherical Navigation

The shortest distance between two points on the earth's surface lies along an arc of a great circle, and the length of the arc is measured in degrees, each degree being equal in length to 60 nautical miles.

Three arcs of different great circles may meet to form a spherical triangle, as in 5, where a is a portion of a meridian, b is a portion of the equator, and c is the arc of the great circle joining A and B. As all meridians cross the equator at right-angles, the angle C will be 90°, but in a spherical triangle, the sum of the three angles is always *greater* than 180° by an amount unknown until the triangle is solved.

When a spherical triangle is right-angled, it may be solved when any two parts are known in addition to the right-angle, by applying Napier's rules.

Napier's Rule 14

Any right-angled spherical triangle may be regarded as comprised of five parts in addition to the right-angle, *i.e.* Fig. 5 is regarded as comprising :—

$$a,\ b\ (90° - A),\ (90° - c),\ (90° - B).$$

If these are written in a circle, as in Fig. 6, any part taken as middle part will have two others adjacent, and two opposite, thus :—

Take (90° − c) as Mid. Part, then (90° − B), and (90° − A), are adjacents, and a and b are opposites.

Then

sin Middle Part . . { tangents of adjacents multiplied together or cosines of opposites multiplied together.

Example :—

$$a = 30°,\ b = 50°, \text{ to find } c.$$

Looking at Fig. 6, a and b are *opposites* to $(90° - c)$, so we put :—

$$\sin(90° - c) = \cos 30° \times \cos 50°$$

or, from Eq. 8,

$$\cos c = \cos 30° \times \cos 50°$$

from which the reader may calculate the value of c.

Another example—

$$a = 30°, b = 50°, \text{find A.}$$

In this case, b is the middle part, and a and $(90° - A)$ are adjacents, therefore

$$\sin 50° = \tan 30° \times \tan(90° - A)$$

or $$\tan(90° - A) = \frac{\sin 50°}{\tan 30°}$$

from Eq. 11 $$\cot A = \frac{\sin 50°}{\tan 30°}$$

from which the reader may calculate the value of A.

From the angle A, the track angle at the start of a journey from A to B may be found, and from the angle B, the track angle at the end of the journey. Intermediate track angles may be calculated by dividing the triangle into smaller triangles, as in Fig. 7, in which values for arcs AC_1, AC_2, etc., may be assumed, and arcs B_1C_1, B_2C_2, etc., calculated together with the angles B_1, B_2, etc., from which the track angles are found. This will enable the great circle track to be plotted upon the pilot's chart, and observations of his positions during the journey will show whether he is on or off the track, and in the latter case, what change in course is necessary.

(*To be concluded.*)

QUESTIONS IN PARLIAMENT

British Cellulose Manufacturing Company

Mr. RAPER, in the House of Commons on April 7, asked whether Lord Sumner's Committee have now been granted the necessary powers to enable them to make a thorough investigation into the matter of the British Cellulose and Chemical Manufacturing Co.; and when the Committee's Report will be forthcoming ?

Mr. Bonar Law : All necessary powers were, in my opinion, granted when the Commission was appointed.

Mr. Raper: Will the right hon. gentleman answer the second part of the question ?

Mr. Bonar Law : I answered that a few days ago. Lord Sumner, who is the Chairman of that Committee, is engaged in Paris in connection with the Reparation Committee, but he hopes to make a Report almost immediately after his return.

Lieut.-Col. C. Malone : Is the right hon. gentleman aware that the British Cellulose and Chemical Manufacturing Co. are about to increase their share capital by £1,500,000, and is this not a good example in which the Chancellor of the Exchequer might enforce his powers ?

Mr. Bonar Law : I do not quite follow that question. The Chancellor of the Exchequer, I understand, has now no power over home issues.

R.A.F. Warrant Officers' Gratuities

Sir F. HALL asked the Under-Secretary of State to the Air Ministry if, in view of the fact that on the amalgamation of the Royal Naval Air Service and the Royal Flying Corps in 1918, warrant officers in the former Service were given the rank of second lieutenant, and that a distinction in this matter was drawn between warrant officers in the two forces on account of the special position they occupied in the Royal Naval Air Service, where their status was similar to that of commissioned officers, as exemplified by the fact that they messed in the ward room, were entitled to a salute, etc., the period of service of warrant officers in the Royal Naval Air Service will rank for the purpose of calculating the amount of the gratuities to which they are entitled ?

The Under-Secretary of State for Air (Maj.-Genl. Seely) : The arrangement suggested by my hon. and gallant friend is now in force.

Junior Flight Officers and Cadets

Mr. RAPER asked the Under-Secretary of State for Air whether some thousands of junior flying officers and flight cadets are living at various aerodromes and Royal Air Force stations and doing no work of any useful character ; and whether some work can be found for them which will enable these officers and flight cadets to be useful to the Royal Air Force in the future if, and when, a reserve force is formed ?

Maj.-Genl. Seely : About 50 per cent. of the officers and practically all cadets now stationed in the United Kingdom are awaiting demobilisation. My hon. friend may be assured that work of a useful character has been and will be found for those who remain, as far as it is possible to do so.

Instructional Flying

Mr. RAPER asked the Under-Secretary of State for Air whether the entire cessation of flying at training stations is due to scarcity of skilled mechanics owing to demobilisation ; and whether flying officers and cadets who have already passed through the technical schools of aeronautics can themselves keep a sufficient number of aeroplanes in flying condition to enable instructional flying to be continued so as to train a number of men for an Air Force Reserve ?

Maj.-Genl. Seely : Scarcity of trained mechanics was one reason for the discontinuance of training, but more weighty reasons were the need for economy and the fact that there are available sufficient trained pilots to meet all probable requirements until the output of pilots commences under arrangements for the Royal Air Force after the War. Flying officers are assisting as necessary in keeping machines in flying condition.

R.A.F. Returned Prisoners of War (Promotion)

Capt. WEDGWOOD BENN asked the Under-Secretary of State to the Air Ministry what is the position of a returned prisoner of war as regards substantive rank ; and does he lose all chance of the promotion to which he would have been entitled had he not been shot down ?

Maj.-Genl. Seely : Prisoners of war on being released are passed to areas, and special orders have been issued that they may be considered for promotion if recommended. Everything is done to make up to them, as far as it is possible to do so, the place they have lost through being taken prisoner.

Aircraft Insurance

Mr. BOTTOMLEY, on April 9, asked the Prime Minister whether he will consider the proposal to apply a portion of the large sum in the hands of the Treasury in respect of premiums upon aircraft insurance policies which were unexpired at the date of the Armistice to the relief of cases of special hardship amongst sufferers from enemy air raids ?

Mr. Chamberlain : I regret that I cannot see my way to adopt the proposal suggested in the question.

Mr. Bottomley : Is it not a fact that the Government have in hand upwards of £10,000,000 accumulated profits on this ? Does the right hon. gentleman propose to keep them ?

Mr. Chamberlain : Yes, Sir ; it is proposed to keep whatever balance there is.

Mr. Bottomley : Hard-hearted Chancellor !

R.A.F. Overseas Recruits' Passage Money

Lieut.-Col. Sir JOHN HOPE asked the Under-Secretary of State to the Air Ministry whether the actual amount paid in passage money by British subjects who came from America to enlist in the Army or Air Forces may be refunded ; and, if not, what is the limit of the amount which may be refunded ?

Maj.-Genl. Seely : So far as the Royal Air Force is concerned, the refund which is made is not necessarily the amount actually paid by the individual. The refund is limited to the amount at which a passage of the appropriate class by the most economical route could have been obtained. This amount is £21 for first class and £7 10s. for third class passages from United States or Canadian ports to England.

North Russia Force (Equipment)

Mr. RAPER asked the Under-Secretary of State to the Air Ministry if the Air Force people originally attached to the Northern Russian forces were at first equipped only with seaplanes, and if the pilots in question had to fly seaplanes 40 or 50 miles inland over wooded and hilly terrain ; and, when the danger of using seaplanes was apparently realised, were our Air Force people in that district equipped with D.H.6's, which machines have a maximum speed of about 50 miles an hour and are unable to make any headway against anything in the nature of a high wind ?

Maj.-Genl. Seely : In situations where it is impossible, owing to the nature of the ground, to erect aerodromes, it is found most convenient to employ seaplanes instead of aeroplanes, provided that water is not too far away. Seaplanes alone were at first employed with the North Russia force for this reason, and will continue to be used. No D.H.6 machines have been sent to North Russia for war purposes, though in certain districts it has been found possible to employ aeroplanes of other types.

Technical Officers (Pay)

Sir F. HALL asked the Under-Secretary of State to the Air Ministry whether technical officers are split up into two grades, namely, Category A and Category B ; whether the former receive technical pay and whether the latter do not do so ; whether the duties of those in Category A include compass officers and inspectors of fire services ; whether those in Category B include those qualified in armament, chemistry, metallurgy, and photography ; if so, whether the duties of those in Category B entitle the officers therein to the same technical pay as those whose duties are to inspect fire services ; and whether he will take steps so that both groups of officers are granted the same technical pay ?

Maj.-Genl. Seely : The answers to the first four parts of the question are in the affirmative ; the answer to the fifth part is in the negative. As regards the last part, the whole question of the future emoluments of officers of the Royal Air Force is now under consideration, and an announcement will be made as soon as a decision is reached.

Experimental Air Postal Service

Mr. GILBERT, on April 10, asked the Postmaster-General if he has made any arrangements for the provision of an aerial post in this country, or between Great Britain and Ireland, or from London to the Continent ; if any experiments or trials have been made with the object of setting up such a postal service, and if he can make any statement on the subject ?

Mr. Illingworth : An experimental service has been established between Folkestone and Cologne for the conveyance of Army mails. No other Air mail service has been established in this country, or with Ireland or the Continent.

Sir H. Dalziel : Does the right hon. gentleman contemplate an early flying service to Scotland ?

Mr. Illingworth : As soon as airmen can find London in a fog and land in a fog it will be practicable, but at present it is quite impossible, because the efficiency is only about 60 per cent.

Wood in Aircraft Factories

Mr. LUNN asked the Parliamentary Secretary to the Ministry of Munitions if he is aware that numbers of men have been discharged from certain aircraft factories within the London area since November 11 last ; that discharges are still being made despite the fact that within these factories there are stocks of raw material suitable for being used in the manufacture of doors, cupboards, stairs, wardrobes, and other necessaries in the construction of houses, and the internal fittings of the same, and that the machinery capable of making these useful articles is now standing idle ; and whether he will consider the advisability of using this material, machinery, and labour for this purpose within these factories or of its disposal for immediate use elsewhere ?

Mr. Hope : There is only one National aircraft factory in the London area to which the conditions indicated in the question would, in any way, apply, and that factory is engaged on the salvage of aircraft rendered obsolete by the termination of the War. I understand that there is sufficient capacity in the country for the manufacture of doors, cupboards, and other house fittings. Materials and machinery suitable for the purpose and surplus to the requirements of the Government are being placed on the market by the Disposals Board.

Mr. Lunn : Is the hon. gentleman aware that at the Graham-White factory in Edinburgh there are several thousand cubic feet of wood, all of which is suitable for house-building purposes, and, having regard to the Government's programme, is it not desirable that that wood should be used for building purposes instead of men being dismissed and coming on to the unemployment fund as they are doing ?

Mr. Hope : The instance I had in mind was not the one at Edinburgh. I have no knowledge of the wood being stored there.

Mr. Lunn : Will the hon. gentleman make inquiries ?

Mr. Hope : Certainly.

THE TRANSATLANTIC FLIGHT

As the days go by, the interest in the race for the *Daily Mail* £10,000 prize for the first man to cross the Atlantic by air increases. Mr. Harry Hawker, the pilot of the Sopwith-Rolls-Royce "Atlantic," and his navigator and assistant pilot Commander Mackenzie Grieve, having tested their machine and had it officially sealed, are ready for the start, watching anxiously the weather and wind, and awaiting with impatience the weather reports sent twice a day from the meteorological branch of the Air Ministry in London. To add to the impatience of the Sopwith crew, Mr. F. P. Raynham and his navigator, Capt. Morgan, have arrived at Newfoundland with their Rolls-Royce engined Martinsyde, the "Raymor," and are getting their mount ready with all speed. without any regard to being first across. It has not, up to the time of writing, been definitely stated who will be the pilot and navigator of the H.P.

The Fairey seaplane, Rolls-Royce engine, which will be piloted by Mr. Sydney Pickles, is also nearing completion, but a certain amount of secrecy as to the plans of this entrant is being maintained. The same applies to the Whitehead contingent, from whom not a word concerning their plans has been vouchsafed.

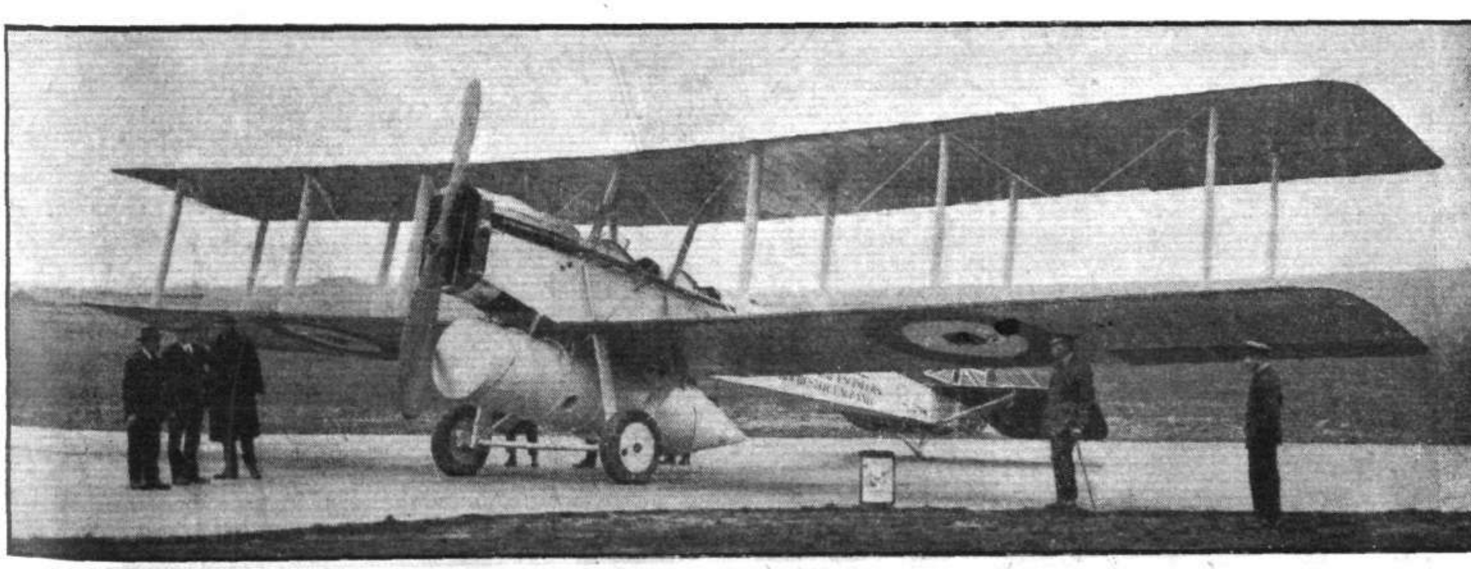
A New Entrant.

While some of the early entrants are ready and waiting for the weather to improve, others are working night and day in order to get their machines ready. Thus it has been

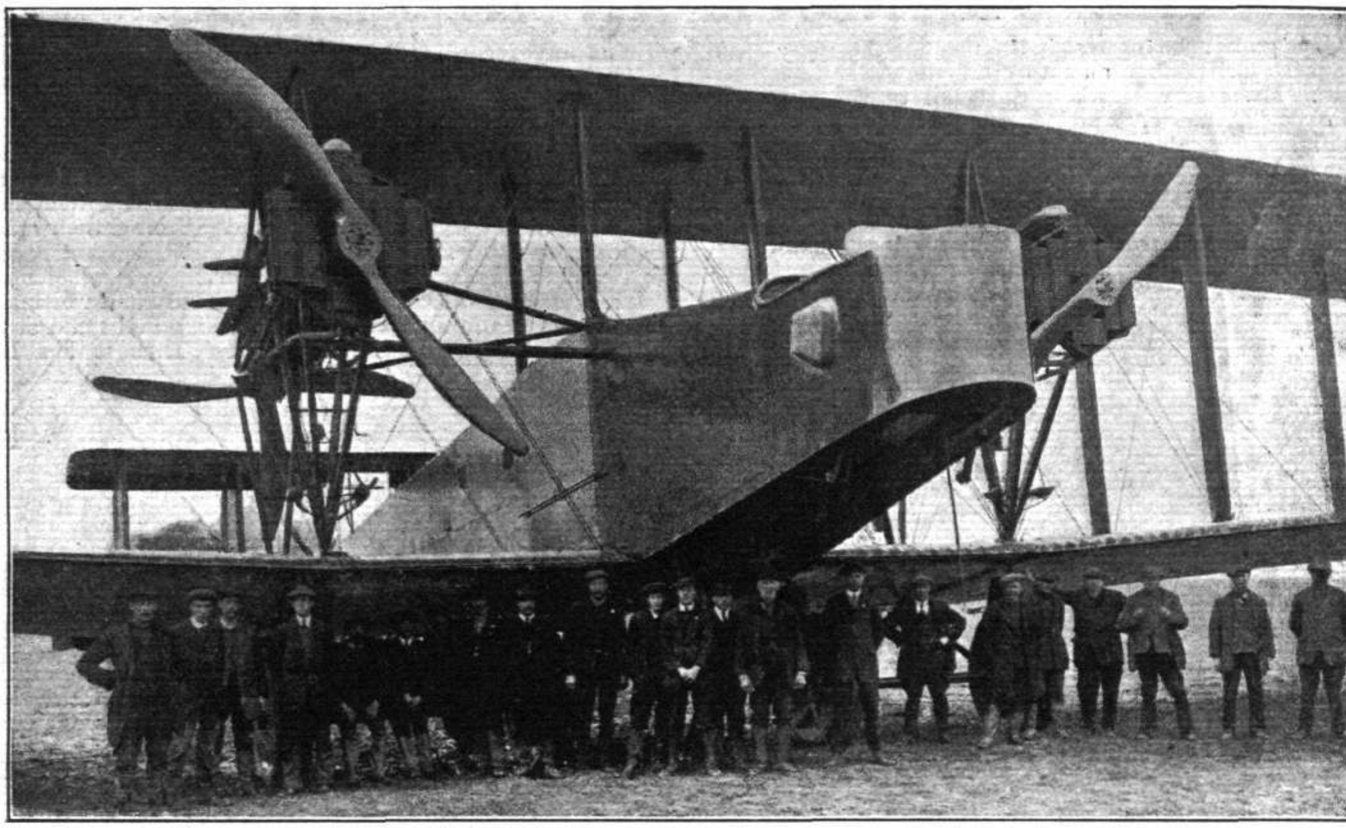
Three-quarter rear view of the Short Transatlantic machine

Every day of bad weather increases their chances of getting ready before the Sopwith machine has had an opportunity to make a start, and if the unsettled weather conditions continue there is every probability that both machines may start more or less simultaneously. Then there is the Short machine, also with Rolls-Royce engine, which, as time is pressing, it is intended to start from this side. This machine also is now ready. It is therefore not an unlikely event that this machine may meet one or more of those making the eastward journey, although, as the routes will probably differ in location as well as in direction, they are hardly likely to get within hail of each other. The Handley-Page giant machine with four Rolls-Royce engines, is stated to be ready for shipment, and the plans call for a start from St. John's about the middle of May. Mr. Handley-Page has stated that the attempt will be made under the best conditions announced that Messrs. Boulton and Paul, Ltd., of Norwich have entered a twin-engined machine fitted with two 450 h.p Napier engines. This machine was originally designed as a passenger carrier, having all the occupants, with the exception of the pilot, enclosed in a roomy cabin. By suitably arranging the wind screen the pilot can be very well protected outside. For the purpose of the Transatlantic journey the great amount of cabin space available will be used chiefly for housing the fuel tanks. It is estimated that she will have a range, when fitted with six tanks (containing 800 gallons of petrol) for the Transatlantic journey, of over 3,000 miles (in still air, of course), which should be ample for making the journey in either direction.

It is the intention of the firm to send two machines of this type to Newfoundland, and Maj. H. G. ffiske will take them over when they are ready, together with a staff of pilots and



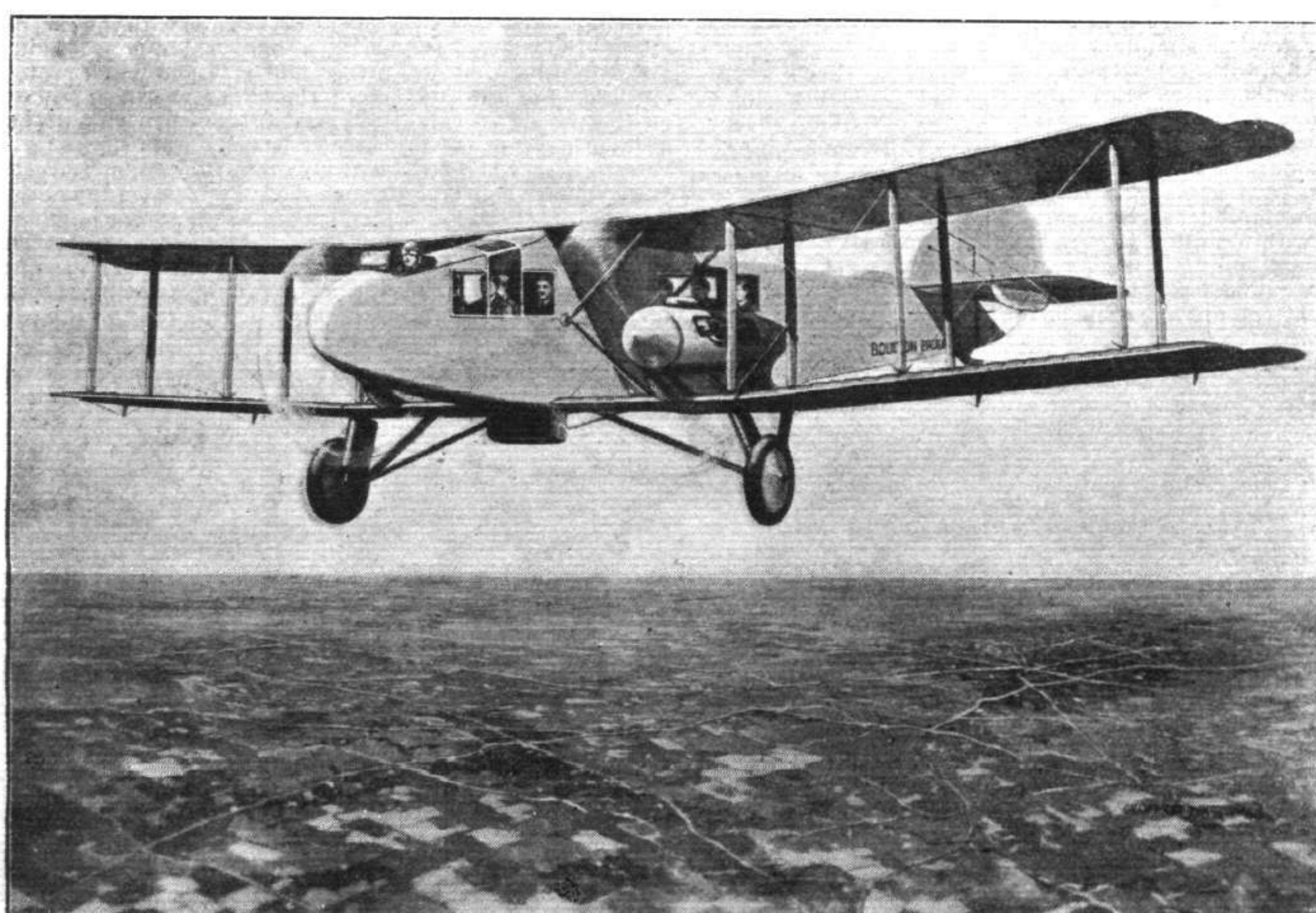
The Short Transatlantic machine to be flown from East to West, piloted by Major Wood, with Capt. Wyllie as navigator



THE TRANSATLANTIC HANDLEY-PAGE.—The illustration gives a good idea of the size of the machine and also shows the mounting of the four Rolls-Royce engines

mechanics. The crew of the competing machine will number three, and has not yet been chosen.

Mr. J. D. North, the designer of the "B.P.," is confident that the machine can do the trip if she can be got ready in time. A special feature of the controls of the Boulton and Paul machine deserves to be mentioned. There is a locking device, mounted near the floorboards of the pilot's cockpit, by means of which the elevator and wing flaps are locked simultaneously in any desired position. The pull on the trigger at the same time automatically changes the rudder control over from the foot bar to the wheel which ordinarily operates the *ailerons*, the steering then being done exactly as in a motor car. This should relieve the pilot of a g eat amount of work, especially as the machine is very stable and will require little or no attention beyond that of keeping her on her course.



THE BOULTON AND PAUL TRANSATLANTIC MACHINE.—Two 450 h.p. Napier "Lions" are fitted. Picture shows machine in original form as a passenger 'bus. For this flight the petrol tanks will be fitted in the cabin space

In addition to the *Daily Mail* £10,000 prize, a cheque for £1,000, given by Mr. Laurence R. Philipps, brother of Lord St. Davids, will be handed to the first British airman who crosses the Atlantic.

The Air Ministry makes the following announcement :—

"Some confusion appears to exist with regard to the wireless call signs allotted to aircraft for the Transatlantic flight."

Each machine is given a group of three letters lying within the limits of D K A to D M Z, which serve as a call-sign and as a rapid method of establishing the machine's identity.

Thus D K A is the wireless call sign of the Sopwith machine competing in the Transatlantic flight.

It is stated that a Handley Page, of the twin-engined type, is being assembled at Harbour Grace, but it does not appear to have been entered for the competition.

Capt. Pollock has recently been testing for Messrs. Vickers, Ltd., a large twin-engined machine which it is thought may attempt the Atlantic crossing.

Sir Alexander Harris, Governor of Newfoundland, inspected the Sopwith on April 12 and handed Mr. Hawker a letter addressed to the King. The machine was officially sealed on behalf of the Royal Aero Club by Major Partridge, R.A.F.

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Personals.

Married

Capt. E. C. W. FITZ HERBERT, D.S.C., R.A.F., son of A. V. Fitz Herbert, Ballintyre Hall, Dundrum, Co. Dublin, was married on April 8 at St. Peter's, Cranley Gardens, to ENID, elder daughter of the late Harold WOOLLRIGHT, Barrister-at-Law, and Mrs. F. C. ERICKSEN, of 14, Vale Avenue, Chelsea.

Capt. EUGENE FLEETWOOD NASH, R.A.F., youngest son of Edward Henry Nash, of Gerrard's Cross, Bucks, was married on March 15 at St. Paul's Rondebosch, Cape Town, to WINIFRED NORMAN, granddaughter of David FRANCIS, Esq., of Tati House, Frognal, Hampstead.

CYRIL HAMILTON BLYTH READMAN, R.A.F., second son of Dr. and Mrs. J. B. Readman, Belmont, Hereford, was married on April 4 to ELEANOR, the only daughter of Mrs. THWAITE (and the late Mr. Newsome Thwaite), 2, Harley House, Regent's Park, W.

Maj. GORDON VERO, R.A.F. (late Rifle Brigade), younger son of the late Francis CAREY, of Burgess Hill, Sussex, and Mrs. Carey, of 85, St. Mark's Road, W. 10, was married on April 1 at Christ Church, Crouch End, to EILA, only daughter of Mr. and Mrs. G. W. REYNOLDS, of Upcote, Shepherd's Hill, Highgate.

To be Married

THE engagement is announced between L. C. G. GEMSON, late R.E. and R.A.F., of Southport and London, and Mlle. MARIE DE-VIRY, Commandant, Red Cross Hospital, Marquise, Pas-de-Calais, second daughter of the late Comte De-Viry, of Bazielles, Ardennes.

The engagement is announced between Lieut. JACK KELVIN LANCASTER, Australian Flying Corps, of 127, King Fellows Road, Hampstead, London, and Miss LILY GEARY, 26, Faure Street, Cape Town.

The engagement is announced between Capt. C. C. SNOW, R.A.F., and GLADYS BURTON, eldest daughter of the late Genl. COLWELL, C.B., Royal Marines, and Mrs. Colwell, Claremont Lodge, Southsea.

The marriage arranged between Maj. FERNLEY TURNER-BRIDGER, The Black Watch (Royal Highlanders) and R.A.F., son of Mr. and Mrs. Turner-Bridger, Anne Cott, Haslemere, Surrey, and DOROTHY ALICE, daughter of Mr. and Mrs. T. JOHNSON NURSE, Ashdene, March, Cambs., will take place quietly at St. Peter's, Eaton Square, on April 19, at 12 noon.

Items.

The new Lord ST. OSWALD, Capt. ROWLAND WINN, who served in the Coldstreams, and was wounded in the first year of the War, is now attached to the R.A.F. He married Miss Evie Carew in 1915.

An 88 squadron dinner will be held on Saturday, April 26. Those wishing to attend are asked to communicate with Capt. A. HEPBURN, R.A.C., Pall Mall, S.W. 1.

Any information regarding Lieut. HAROLD BARTLETT BRADLEY, No. 1 Sqdn., R.A.F., who has been missing since June 25, 1917, will be gratefully received by his mother, Mrs. Carrington Heming, 57, Union Street, Mountcalm, New Jersey, U.S.A.

Lieut. J. S. Mc.D. BROWNE, 19907, R.A.F., was last seen flying Le Rhone Camel 9510 from No. 4 Squadron, Australian Flying Corps, Hazebrooke Sector, on June 27, 1918. Anybody who can give information concerning his fate is requested to write to Lieut. W. G. M. Browne, R.A.F., Lyndhurst Avenue, Toronto, Canada.

Pilot-Lieut. C. H WOODS and Observer-Lieut. McLEAN were reported missing on September 21, 1917. They were flying a Bristol fighter, No. 7,234, and were last seen to land near Menin. Anybody who can give further particulars is requested to write to Lieut. Lloyd M. Archibald, R.A.F., 87, Woodlawn Avenue, W., Toronto, Ont., Canada.

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ROLL OF HONOUR

Previously Missing, now reported Killed

Published April 3

Jack, Capt. T., M.C., Aus. F.C.
Jeffers, Lieut. J. P., Aus. F.C.
Feel, Sec. Lieut. J. C., Aus. F.C.

Published April 4

Killed

Adams, Capt. A. P.
Allen, Sec. Lieut. C. A.
Kellough, Sec. Lieut. W. R.
Kennedy, Sec. Lieut. W.

Died of Injuries

Raw, Sec. Lieut. W. A.

Died

Moore, Lieut W. V.
Payne, Maj. S. J.
Sinclair, Lieut. R. B.

Published April 10

Previously reported Missing, now reported Killed

Reading, Sec. Lieut. V. J.

Killed

Stennett, Lieut. W. R.
Wilson, Lieut. H. B.

Died of Injuries.

Glanville, Capt. H. F.

Died

Delaney, Capt. M.
Hutchison, Sec. Lieut. H.
Russell, Capt. C. E. S.

Wounded

Buxton, Maj. V.
Eastwood, Sec. Lieut. D. D. M.
Redmond, Sec. Lieut. W. D.

Missing

Nunan, Sec. Lieut. N. D.
Tattam, Sec. Lieut. F. F.

Repatriated

Branford, Capt. F. V.
Jenks, Lieut. J. C. A.
Kinmond, Lieut. D. C.

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Intercollegiate Contests at Atlantic City

IN connection with the Pan-American Aeronautic Convention and Exposition which is to be opened at Atlantic City next month, the Aero Club of America is organising a series of intercollegiate competitions open to college men who have served in the U.S. Air Services, including events for seaplanes, aeroplanes, airships, spherical and kite balloons will be included.

Annual Competition for U.S. Service Flyers

THE New York *World* has offered a trophy for an annual competition among Army, Navy and Marine pilots. Arrangements are being made for the first contest to be held at Atlantic City in May, and the trophy will be won by the pilot making the longest non-stop flight over land or water from Atlantic City to any other point.

SOME FUTURE POSSIBILITIES OF AEROFOIL DESIGN

By W. E. ASTIN

MR. FAGE, discussing present day aerofoil practice in his book on "The Aeroplane," predicts that "it is possible that the near future may see startling changes in the design of machines." Of necessity, therefore, he is a bold man who ventures to predict the future of aeroplane design. Several of "FLIGHT'S" contributors lately, having been emboldened to consider future possibilities, have dealt with body and strut resistances and their reduction to a minimum. Aerofoil resistance has been discussed but little, although it is generally the largest individual resistance in an aeroplane.

With wings of fixed area, angle of incidence, and camber, fixed rigidly to the *fuselage* of the machine, progress in resistance reduction, as far as wing resistance is concerned, is restricted to within narrow limits. It is possible therefore that such rigid wings will not persist, but will in time be replaced by wings which may be :—

(*a*) of variable area.
(*b*) of variable angle of incidence.
(*c*) of variable camber.
(*d*) of any suitable combination of these variables.

It is noticeable that each of these methods has disadvantages which slightly (or greatly) reduce its value. This, of course, is only on a par with the generally accepted principles of aircraft design, which involve endless compromises. Of these three variables, the variation of area during flight presents an engineering problem of very considerable magnitude, and it will conceivably be many years before a really satisfactory method of altering aerofoil reactions by this means will be generally adopted. As the production of a plane of variable area in which variation is obtained by increasing, or decreasing, the chord (in order to avoid the difficulties of telescoping the wing spars) appears to be less difficult than one in which the span is altered, it is possible that this mode, in spite of its low efficiency, may have some vogue. If so, in order to obtain good results, it would be necessary to proportion the gap according to the maximum chord, thus producing a very high gap at minimum chord and high speeds. This, of course, would entail high strut resistances; while alteration of the span would probably entail very extensive rigging. A method of altering the effective area of the planes will be discussed later in these notes under the heading of "Decalage."

A variable angle of incidence (which is really a method of *fuselage* resistance reduction) has already been incorporated into a number of machines of Continental and American design, notable examples being the Breguet, with wings which automatically adjusted their angle of incidence, the Paul Schmitt, and a certain Etrich model, in which the pilot could adjust his wings from his seat during flight. These machines are already familiar to readers of "FLIGHT." A mathematical consideration of this method, combined with practical observation of present progress in this direction, shows that the improvement in performance obtained from a variable angle of incidence is of necessity slight. Nevertheless there is an improvement. Its chiefest advantage lies in the fact that the axes of the propeller and the *fuselage* lie always parallel to the direction of motion, thereby reducing the pilot's troubles. By suitably notching the ramps of the lever controlling the planes, exact angles for high speed, maximum climb, and minimum speed may be obtained readily. Against this can be set the fact that in a "fixed angle" machine the "resistance co-efficient" of the *fuselage* decreases as the speed increases because the *fuselage* assumes its parallel position only at high speeds. The resistance of the *fuselage* therefore does not increase quite with the square of the speed (approx.). The upward component of the tractor pull at low speeds assists the planes in ordinary machines, as also does the *fuselage*, enabling slightly smaller planes (or lower speeds) to be used. For manœuvring purposes, all the usual controls would be fitted whether they be standard, or of the Dunne or any other unusual type. This applies equally of course to wings of any variable type, whether area, angle or camber be altered, as no manipulation of wings as at present used would appear likely to give greater manœuvring power, than rudder and elevator control. Flapping wings may or may not be superior to present day control. They do not however enter into the present discussion.

We therefore turn to the variable camber as a possible means of extending speed ranges, and reducing resistance, and it is of the possibilities of a variable camber, with or without a variable angle of incidence, that this article more particularly treats. As an engineering problem, a variably cambered plane is infinitely simpler than a plane of variable area, although more difficult than a plane of variable "incidence."

Before proceeding to consider the advantages of a variable camber, it will be as well to enumerate the principal disadvantages which it is the engineers' business to overcome. They are three :—

(1) Increased weight of the wings, which may, unless carefully watched, neutralise the improved efficiency.
(2) increased complexity, with greater risk of breakdown.
(3) In a military machine, increased area of vulnerable target.

These disadvantages occur in wings of any variable form. The travels of the C.P. during the change from one camber to another is a point to be closely studied. In the case of a machine fitted with I struts, in which the camber is varied by drawing down the leading and trailing edges, alteration of camber will also slightly alter the angle of incidence, as illustrated in the sketch, Fig. 1.

The variation of camber also affects the angle of maximum lift co-efficient. For a deep camber this may be 14 deg.–15 deg., whereas for a flat camber the angle is more usually of the order of 15 deg.–16 deg. This rule is not, however, invariable, *e.g.*, sections U.S.A. 4 and 6 referred to hereafter. The qualities most to be desired are rapidity of action and absolute reliability. All the above-mentioned disadvantages can be overcome by skilful designing, by use of the best materials, to reduce the weight, etc. and by the use of simple methods to reduce the number of working parts. The all-metal wing, which is coming, one assumes, will facilitate the fitting of the mechanism of variable camber.

The characteristics of the aerofoil are well known to readers of "FLIGHT." It is sufficient for the purpose to recapitulate the general statement that an aerofoil of flat camber has usually a low lift co-efficient and a very low drag co-efficient, with a high L/D ratio, at low angles of incidence, whereas a deeply cambered aerofoil has usually an inferior L/D ratio at small angles, but at large angles of the order of 15 deg. has a high lift co-efficient. Therefore in designing our machine of the future, we should arrange so that for high speeds, we should employ a small angle of incidence and a

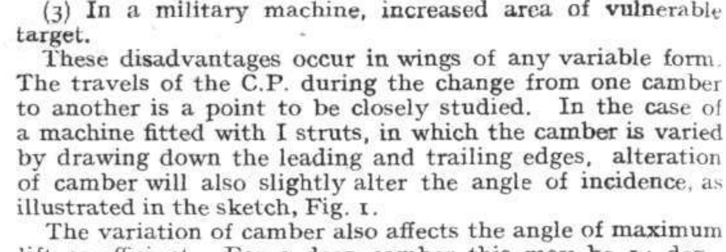

FIG. I.

flat camber, while for low speeds a large angle of incidence and a deep camber would be used. The variation of the angle of incidence may be obtained either by mechanism operated by the pilot, the axis of the *fuselage* remaining parallel to the line of flight, or by inclining the whole machine, as at present, by means of the elevator. The mechanism could be operated separately from that altering the angle of incidence, or with it, the lever or wheel setting the correct angle and camber conjointly. The latter method is preferable as it would prove less trouble to the pilot, being easier to manage, and it would discourage experiments in combinations of angles and cambers on the part of young and enthusiastic or ignorant pilots, except under proper conditions. But the matter does not end with this. In order to get the highest speed it would appear proper to set our planes at the angle which gives the maximum L/D ratio. At this angle it is quite likely that the lift of the planes will be excessive. To avoid this to-day it is necessary to compromise by either using an angle which gives the correct lift although the drag may not be absolute minimum (though very near it) or else by reducing our wing area and tolerating a high minimum speed. As it is always the last decimal place in aeroplane co-efficients which counts for higher efficiency, these compromises represent merely a phase of construction which must sooner or later be superseded.

The usual speed machine of to-day is either a biplane or triplane. Monoplane construction is out of favour at present for reasons of strength and reliability, and multiplane construction for speed machines is hampered by reason of the fact that the aerodynamic efficiency of the intermediate aerofoils is of the order of 50 per cent.–60 per cent. Thus the greater proportion of wing area embodied in inter-

mediate planes, the nearer does the efficiency of the whole system approach 50 per cent.–60 per cent. As, for high speed machines, high aerofoil efficiency is desirable, a biplane or triplane with the nearest approach to monoplane efficiency as exemplified by the wing systems of the Nieuport or Albatros

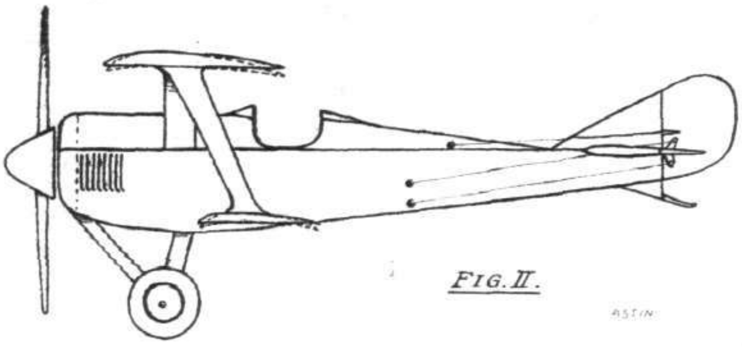

FIG. II.

D4., promises the highest speed for a given power, other things being equal. Therefore it is reasonable to assume that biplane or triplane construction will remain as standard, and it is now possible to consider how improvements may be effected by the employment of variable camber.

In practice this would mean the employment of a large upper plane and a smaller lower plane, connected by I section struts, the flat and deep cambered positions of the aerofoils being as shown in the sketch, Fig. 2.

It is not necessary for both planes to be set at the same angle of incidence. Nieuport machines described in "FLIGHT" for August 30th, 1917, were arranged with angles of incidence for the upper plane of 2½° and for the lower of 3½°. A Wright Martin tractor also described in "FLIGHT" was fitted with an upper plane set at 1° greater angle than the lower plane. This latter arrangement, known as "Decalage," accompanied by stagger, makes for stability. (See "Stable Biplane Forms," by J. C. Hunsaker in *Engineering* of January 7th, 1916.) As, however, its damping effect upon longitudinal oscillations is probably small, a tail is still required (although it may be made smaller, or given less leverage), and as a plane system incorporating decalage requires more power

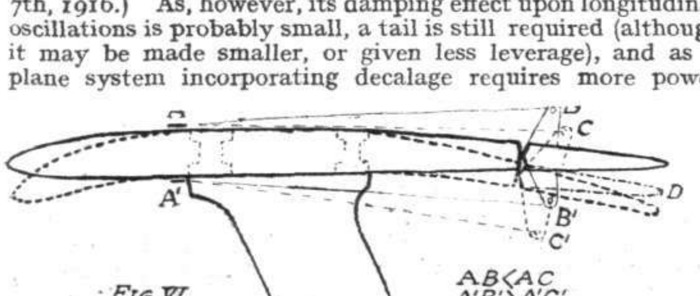

FIG. VI.

When the camber is increased, the control wires raise the ailerons, thus reducing the camber, as shewn at D.

than one without, in order to give the same results, it is unlikely to be generally used unless improved applications of the system can be evolved. One such occurs to the mind in connection with variably cambered wings. For low speeds the planes are carried as usual at 15°–16° either by altering

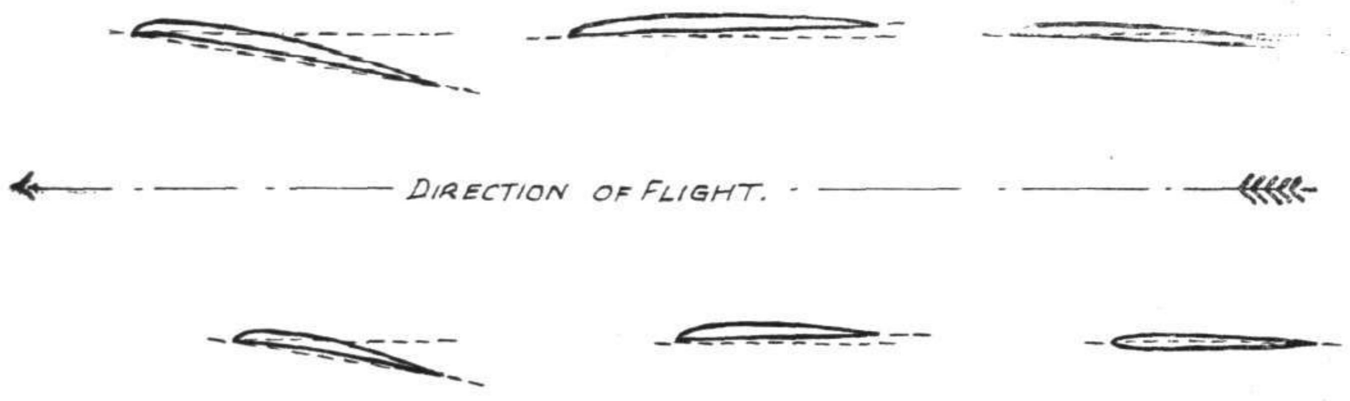

FIG. III.
Attitude at Minimum Speed
Aerofoils at 14°-16° angle of incidence.

FIG. IV.
Attitude at Maximum Speed
Aerofoils at very low angle of incidence (possibly even at negative angles).

FIG. V.
Suggested Attitude at High Speeds: Upper Aerofoil at Max L/D position. Lower "Neutral".

ASTIN

their angle relatively to the *fuselage*, or by flying the entire machine at the correct angle. In this position the planes may both be set at the angle of maximum lift. The camber is deep and the whole arrangement is shown in Fig. 3. By reducing the angle and camber respectively, to 3° say, and a "high speed" profile, we obtain a certain high speed with the resistance at its minimum. For extreme high speed in ordinary machines it might even be advisable to use negative angles of incidence as represented in Fig. 4. At these angles the L/D ratio varies from +1 to +10 according to the profile used, whereas the maximum L/D ratios of cambers (of which details are published) range from +15 to +18. Thus even with the altered camber and angle, the wing resistance is twice or more times as great as it would be if the area of the planes when set at maximum L/D position just supported the machine at high speed. Herein lies a possibility of combining Decalage with variation of the camber. (Should the above reasoning not appear clear, a mathematical example is given later on with a view to showing concretely the advantage which might be obtained from the system about to be discussed. (Fig. 5 helps also to "explain" the text.) In the improved machine incorporating Decalage, the two or three planes are not altered in the same manner. The upper plane is varied from a "low speed" to a "high speed" profile, and the angle of incidence is varied from +15° to +3°. The area of the upper plane just supports the load at top speed. (Note, in practice this lower limit of 3° may not prove possible, but angles of +1° or +2° may, in which case the L/D ratio would not be quite a maximum, but would be very near it. (The lower plane is varied from a "low speed" profile, to a double-cambered symmetrical plane, and the angle is varied from +15° to zero. Thus at high speed the upper plane contributes the entire lift, and the lower plane contributes only the minimum resistance, *e.g.*, frictional and streamline resistances. At low speeds both planes contribute their share of lift. This arrangement is equivalent to altering the area of the lifting surfaces of the aeroplanes, by the amount of the area of the lower plane. The lower plane may be equal to the upper plane, as it is approximately in the Sopwith or Bristol, or much smaller than the upper plane as in the Nieuport or "Curtiss wireless" machines. The area of the planes relatively to

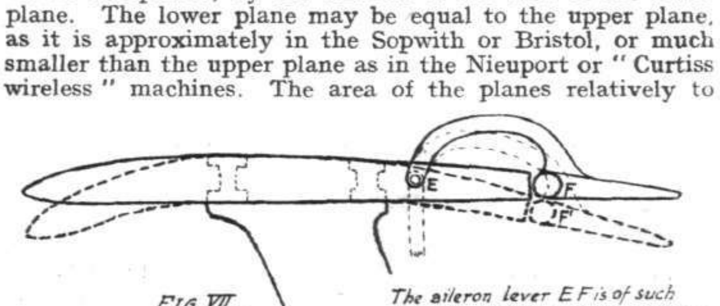

FIG. VII.

The aileron lever E F is of such a length that the point E remains constant for each camber employed when the ailerons are "neutral"

one another would then depend on the lift coefficients of the various sections employed. The resistance of the planes adjusted in this way would be brought to a minimum.

The same construction could be made to apply to a triplane, in which case the lower plane alone, or both the lower

and middle planes could be "washed out" entirely, according to the amount of lift required at top speed. If anything the triplane should yield better results than the biplane.

To illustrate this method the speeds and resistances of a hypothetical triplane system are appended. Assuming a machine of 1,400 lbs. weight loaded (constant weight assumed). The total aerofoil surface is 200 sq. ft., giving a loading of 7 lbs. per sq. ft. The area is distributed among the planes as follows: Upper plane, 100 sq. ft., span 25 ft., chord 4 ft.; middle plane, 55 sq. ft., span (allowing for *fuselage* 3 ft.) 25 − 3 = 22 ft., chord 2 ft. 6 ins.; lower plane, 45 sq. ft., span 18 ft., chord, 2 ft. 6ins.; leading edges of planes staggered 1 ft. 3 ins. in each case; gap 3 ft. in each case. The aerofoil section used is U.S.A. 6., and the machine is fitted with fixed planes on present-day lines. Another machine of the same weight, area and distribution of planes, and the same loading per sq. ft., is fitted with variably cambered planes, and uses for low speeds U.S.A. 4 on all planes, and for high speeds, U.S.A. 6 on the upper plane only, the two lower planes being reduced to a symmetrical double-cambered section.

In parentheses, in this connection, it must be pointed out that the thicknesses of U.S.A. 4, and U.S.A. 6 differ. Accordingly the planes used must be of some intermediate thickness, or of the thickness of U.S.A. 6. When U.S.A. 4 then is used, it is the upper surface which is correct, the lower surface being slightly more deeply cambered. Reference to "FLIGHT" of August 23rd, 1917, will make this clear. For the sake of the argument, it must be assumed that the slight difference to U.S.A. 4 will not affect its characteristic "curves." In the future, of course, profiles of equal thickness may be evolved, as alteration of thickness would involve intricate mechanism, which might easily weigh so much as to countervail the advantage of the corrected thickness of the profile.

For the resistance of double-cambered surfaces, the formula "twice the skin friction" is employed. This would fairly well accord with the facts, being in all probability on the high side. Fage gives the ratio for a stream-lined body of torpedo form, as 6/5 × skin friction, but figures for aeroplane tails suggest that the formula chosen would be nearer, in the case of zero angle of incidence. The resistance of this type of plane would then be approximately expressed by $R = 2KSV^N$ where $S = 2A$, A being the area of the wings or plane. For the coefficients K and N, Zahm's figures as quoted by Fage are taken, the figures being those for a fine linen, treated with three coats of varnish and two coats of spar varnish (No. 8 in the list on page 168 of *The Aeroplane*). K here equals $\frac{157}{107} = .0000157$ and $N = 1.84$. Thus for 100 sq. ft. of plane area the formula becomes $R = .0000314 \times 200 \times V^{1.84} = .00628\,V^{1.84}$, V being in miles per hour, and R being in pounds. Having settled the data to use first it is necessary to get out the figures for the rigid machine. Triplanes are slightly less efficient at high speeds than biplanes, though at low speeds the difference is negligible. Allowing for gap = 3 ft., for stagger and for the large upper plane, the figure for efficiency will be taken as 90 per cent., although for an orthogonal triplane it would be of the order of 75 per cent.–80 per cent. As the same figure will be used right through the calculations for both machines, its accuracy or inaccuracy will not affect the results obtained for purposes of comparison.

The Body of the calculations of the example is omitted; it is worked out, of course, on the standard formula, $L = KyEAV^2$ where $L = 1400$, E = the efficiency for a triplane, viz., 90 per cent. accepted from above, A is the wing area and V the velocity (taken here in m.p.h.). Ky is taken from the tables in "FLIGHT" for August 23rd. 1917.

Minimum Speed.

$L = KyEAV^2$ where E = 90 per cent. and A = 200 sq. ft. *i.e.*, 1400 = .00298 × 90 per cent. × 200 × V^2 (angle of incidence 14°).

From which $V^2 = \frac{70}{.02682}$ and $V = 51.0$ m.p.h.

Similarly for maximum L/D position, and for speeds of 110, 120, and 128 m.p.h. The results are grouped in Table A.

The calculation for the variable-cambered machine at 128 m.p.h. is as follows:—

$1400 = Ky \times 90$ per cent. $\times 100 \times 128^2$.

Here it is to be observed that A has been reduced to 100, viz., the area of the upper plane.

From which $Ky = .00095$, for which value the angle of incidence is ½° and the L/D ratio 14.5.

$$\therefore R_{TP} = 96.5 \text{ lbs.}$$

For the two lower planes $R_R = .00628 \times 128^{1.84}$

By Logs. we have $R_R = 47.3$ lbs.

The total resistance is therefore 96.5 + 47.3 = 143.8 lbs., a trifle more than the resistance of the aerofoils of the standard machine at 110 m.p.h.

TABLE A.

	Standard Machine.				Variable Machine.			
	Speed.	Angle of Incidence.	Camber used.	Resistance.	Speed.	Angle of Incidence.	Camber used.	Resistance.
			U.S.A.	lbs.			U.S.A.	lbs.
Minimum ..	51.0	14°	6	200.0	46.2	15°	4	140.0
At maximum L/D ratio	72.9	3°	do.	80.7	72.9	3°	U.S.A. 6	80.7
At maximum L/D ratio (variable machine only)	—	—	—	—	103.2	3°*	†	72.2
—	110.0	−¾°	do.	140.0	110.0	2¼°*	†	118.0
—	—	—	—	—	120.0	1°*	†	130.0
—	—	—	—	—	128.0	½°*	†	143.8

* Top plane only. Lower and middle planes here are at zero angle of incidence.
† Top plane U.S.A. 6, others neutral.

The centre of pressure travel is roughly represented by the following table:—

TABLE B.

Standard Machine.			Variable Machine.		
Speed	Angle of Incidence	Distance of C.P. from vertical plane containing L.E. of Upper Plane.	Speed	Angle of Incidence	Distance of C.P. from vertical plane containing L.E. of Upper Plane.
51·0	14°	1 ft. 9 ins.	46·2	15°	1 ft. 7 ins.
72·9	3°	2 ft. 2 ins.	72·9	3°	2 ft. 2 ins.
110·0	−¾°	2 ft. 11 ins.	110·0	2¼°	1 ft. 8 ins.

From which it will be seen that the C.P. action in the variable wings is peculiar. This is, of course, due to the elimination of half of the lifting area of the planes at high speeds. This travel of the C.P. is a matter for very close examination, and for investigation in laboratories and designing offices.

From the tables given above it is possible to deduce that, allowing for increased *fuselage* and strut resistance, &c., a speed of 120 m.p.h. (approx.), should be attainable in the variable machine for the same power as would give 110 m.p.h. in the standard machine. The landing speed being 5 m.p.h. less in the variable machine than in the standard, a safer landing could be effected.

Alternatively by increasing the loading on the variable machine, by putting in a larger engine (and the necessary increase in strength of construction) so as to bring the minimum speed to the same as that of the ordinary machine here discussed, a greatly superior top-speed could be obtained, probably about 130 m.p.h.

The big differences in the angles of incidence at high speed should be noted. In the standard machine at 110 m.p.h. an angle of incidence of −¾° must be used. This is very near to the lower limit for the section (−3°). A slight oscillation of the machine will produce a condition of "no lift," with consequent discomfort to the pilot. In the variably-cambered machine at a speed of 120 m.p.h. the single plane is set at 1°, this being 4° above the lower limit. The action of the "washed out" planes would appear to be somewhat analogous to that of the tail. They might, however, it is true, cause "hunting," but in designing the machine, due regard to this would be paid in settling the tail area.

Another problem in the design of variably-cambered machines, is that of the *ailerons*. This is more particularly the case in the variable machine just discussed. The wires operating the *ailerons* cannot be led down to the lower plane, at any point, as the vertical distance between the planes is not constant. The slack could, of course, be taken up mechanically, but this tends rather to asking too much of the designer. Neither could the wire be taken to the interplane strut, for the same reason. Nor, too, could warping be employed, for these reasons. Because of the alteration

of curvature of the plane, lessening the chord slightly, the under wire could not be carried to a point on the plane itself. The only system which would satisfactorily operate *ailerons* on such a plane appears to be an adaption of the Nieuport, in which the lever is of such a length that, as the rear spar of the plane descends during alteration of camber, it would ensure that the *aileron* descended proportionally. Figs. 6 and 7 represent the method in its application to the method of altering camber at present under discussion, viz., by pulling down the front and rear edges of the aerofoil. In a system, however, in which camber is varied by raising the centre (as has been tried) these difficulties do not exist, nor would they arise in a machine with washed out, or partly washed out, wing tips, in which the camber was not varied at the tips. Nor yet would they occur in machines with upper and lower planes of equal size, in which the planes were all altered in the same manner.

A further advantage of a variable camber is that it would permit in case of emergency a certain amount of overloading of the machine, not that this fact should be made an excuse for habitually overloading such machines.

It might be found that it was advantageous to employ several different sections in one machine, so that for speed, slow speed, climb, &c., different sections should be employed, one merging into another as the pilot pulled his lever through. Thus one section gives the best results at 15°, another at 0° or 1°, while a third gives better results than either at 6° or 8°. In this case, therefore, a ramp would be fitted to the lever, marking the position for each speed, or climb. This principle could be extended so that for each given angle of the aerofoils, the section giving the best results should be employed. Thus one can visualise a machine of the future, within which at the pilot's side, out of the way but within easy reach, there is a wheel, a turn of which adjusts his angle of incidence (a scale and pointer informing him of the angle), and at the same time, for each angle, adjusts his camber, flexing the planes, to each angle the camber which suits it best.

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Hotels Released by Air Ministry

The Secretary of the Air Ministry announces that the Adelphi Hotel (which was occupied by a portion of the Air Ministry) and the Covent Garden Hotel (which was occupied by the Headquarters, South-Eastern Area, Royal Air Force) have been given up and are no longer occupied by Air Ministry or Air Force *personnel*.

The R.A.F. London Reception Depot

The Air Ministry announces that No. 1 Reception Depot has removed from 40, Upper Brook Street, Mayfair, W., and is now established at 4, Henrietta Street, Covent Garden, W.C.

The R.A.F. Exhibition to Visit Leeds

Arrangements have now been made for the R.A.F. exhibition, which has recently concluded its stay at Newcastle, to move on to Leeds. A site at Roundhay has been approved, and it is expected that the exhibition will open early in May.

A New London-to-Paris Record

A new record has been established by a R.A.F. pilot for the flight from London to Paris. Starting with dispatches from Hendon Aerodrome at 3.20 p.m. on Tuesday week and following the Dieppe route, involving a sea crossing of 70 miles, the pilot landed at Paris (Buc) in 1 hr. 15 min. after his departure.

As the distance from point to point is 215 miles, the average ground speed of the machine was 172 m.p.h. The machine was a Martinsyde single-seater scout, fitted with a 275 h.p. Rolls-Royce "Falcon" Mark III.

The Aerial Mail to Cologne

During three weeks, the aerial mail service carried on by No. 110 squadron using Airco (D.H. 9A) machines, between Maiscoucelle and Cologne—a distance of 225 miles—there were only three days when the weather prevented the mails being carried, and there was only one forced landing; 465 bags of mail were carried, and the average time for all flights was 2 hrs. 16 min., while the record was 1 hr. 45 min. On the majority of days on which the mails were carried from March 1 onwards it was found impossible to continue the training of the homing pigeons attached to the unit. Moreover, as it was necessary to fly through driving rain, specially protected propellers had to be supplied, as the rain so seriously damaged the ordinary type during one journey that they became unsafe for further use.

Brussels-London-Paris-Brussels

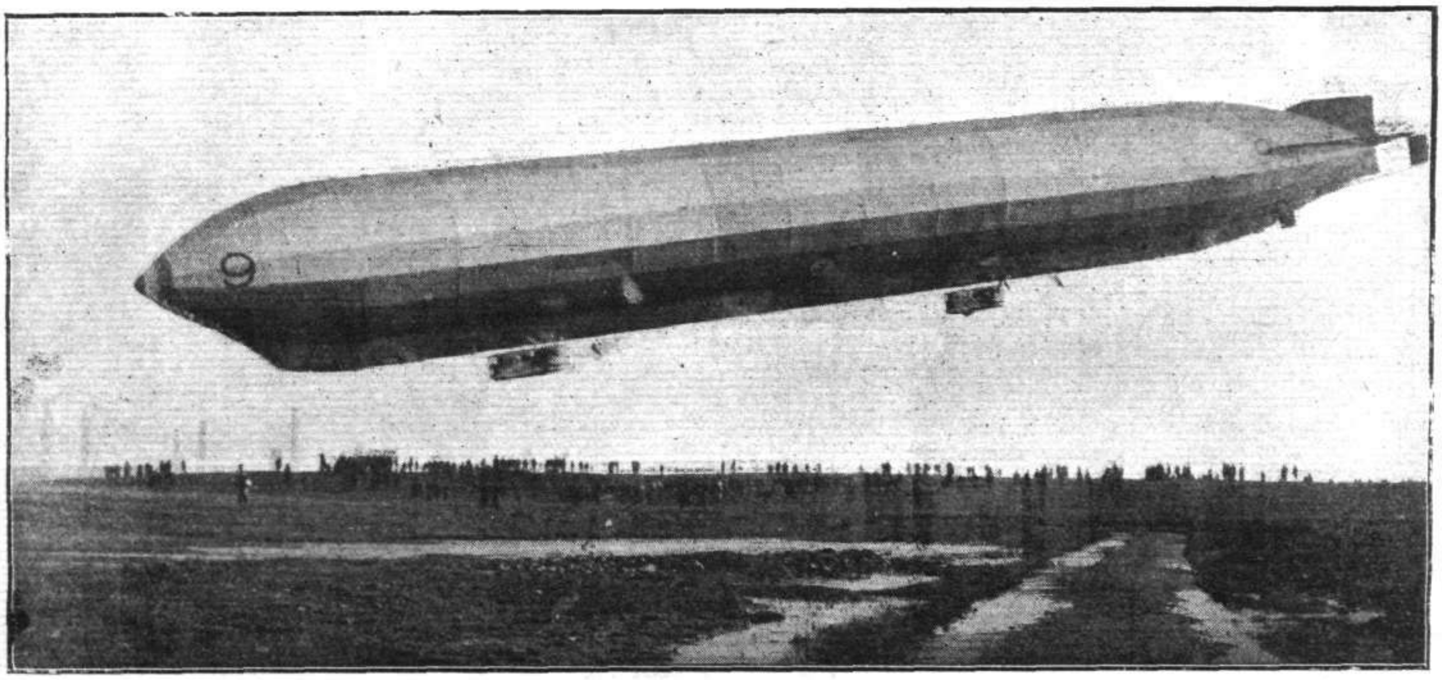
Piloted by Lieut. Georges and carrying two passengers, a Belgian two-engined Army aeroplane has accomplished a circular flight from Brussels to London and Paris and back to the starting-point, about 570 miles, in 7 hrs. 20 mins. actual flying time.

Over the Alps

The spectators at the Olympic sports at Lausanne were somewhat surprised on April 6 by the arrival of fourteen French aeroplanes, including six which had been captured from the Germans. They had started from Nancy, and crossed the Jura Alps, which were covered with deep snow.

"Aerial Navigation"

This will be the subject of a lecture by Major H. E. Wimperis, R.A.F., on Wednesday, April 30, at 8 p.m. The meeting will be held at the Royal Society of Arts, John Street, Adelphi, W.C., and Major-Gen. R. Brooke-Popham, D.S.O., R.A.F., will be in the chair. Tickets can be obtained from the Secretary of the Royal Aeronautical Society, 7, Albemarle Street, W. 1.



British rigid airship R. 9, one of the earlier war aircraft, 520 ft. long, built by Vickers, Ltd., with engine and transmission gear by Wolseley motors

AIRISMS FROM THE FOUR WINDS

ALL the complicated issues involved in arriving at an all-round satisfactory basis for future navigation of the air are one by one being gradually smoothed out at the Paris Aerial Convention, and conclusions arrived at which, at least as a start, may well serve to place general flying upon a possible practical plane. The work is without question a tremendous undertaking, although to the casual thinker it may appear to be a very simple matter. Already the juridical and military sub-committees of the Aeronautics Committee of the Peace Conference have been able to get out a tentative draft navigation convention. This, which is reported upon by Capt. Bacon, M. de Lepradelle and Prof. Buzzati, comprises 41 articles. Main issues have been brought into something like focus, so far as general principles are concerned, such as the sovereignty of the air above, with concessions as to free passage between the various countries, the recognition of prohibited zones, identification of national aircraft, international aerial lines, etc. It is proposed to establish a permanent International Aerial Navigation Committee, which, amongst one of its chief duties, will take into consideration necessary amendments of the convention, to enable the clauses to be kept in line with aerial navigation progress as it develops. This is one of the wisest possible provisions, as without such a provision the world may have to conform to rules and regulations hopelessly obsolete in a year, or even less elapsed period. Power is also to be vested in the committee as to the interpretation of the technical regulations of the convention. The sooner these decisions are now promulgated the better, as it will then be possible to gauge the extent to which commercial and sporting aviation are likely to be handicapped by necessary or vexatious restrictions.

ALREADY lack of unity in France between some of the authorities controlling the aerial postal lines in operation is causing criticism and an unnecessary amount of confusion owing to the absence of co-operation. In fact, judging by reports to hand, the organisation of the eight services already in being serves as a very good example of how not to do it. These lines are directed by :—

(1) General Headquarters, which directs the lines Paris–Lille, Paris–Brussels, and Paris–Strasburg.

(2) The service of civilian aviation, attached to the Ministry of War, which has charge of the lines Paris–Maubeuge–Valenciennes, Nancy–Longwy–Briey–Nancy, and Paris–Bordeaux.

(3) The administration of Posts and Telegraphs, which controls the services between Paris–Saint Nazaire, and Tarascon-Nice.

Feeling is growing that the sooner these are brought under some central control the better it will be for aviation progress and for efficiency.

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BY way of a practical demonstration of an aerial Commission's belief in utilising the means of travel they are out to champion, the return last Saturday *via* the air of the Dutch Government Commission which has been in England studying the details for a proposed air-post between this country and Holland, should be hard to beat. Leaving Felixstowe by plane at 2.50 in the afternoon, a safe landing was achieved at Amsterdam at 4.23, the distance being about 170 miles. Having regard to meteorological conditions, this was not bad travelling.

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LEEDS is the allottee of four large Zeppelin engines by the Enemy Aircraft Department of the W.O.

What Lower New York looks like from the Air. A photograph taken from an aeroplane showing the skyscrapers of the City. The Equitable Building is at the right. On the left may be seen the Singer Building, the Woolworth Building and in the background the Municipal Building, and the suspension bridge. The huge draught "radiators" make one wonder in regard to "Ancient Lights" with respect to some of the small fry crawling below.

ENGLAND TO INDIA.—Photograph of the Handley-Page biplane, fitted with two Rolls-Royce engines, which flew from England to India, landing at Delhi on the 12th December, 1918. Its first flight was made from England to Egypt during the War, when it had some interesting experiences. On arrival in Egypt, it took an active part in the final advance of the British Forces in Palestine, one of its feats being the dropping of large bombs on the Headquarters of the Turks. Owing to the rapid advance of the British, it was difficult to establish advanced aerodromes, and as there were no roads it was difficult to bring up the supplies of petrol. On the arrival of the H.P. this machine was successfully employed for taking petrol up to the aerodromes, thus greatly assisting the British machines. On being congratulated on the flight, General Salmond paid a tribute to the Rolls-Royce engines, and, excellent as the machine is, the Rolls-Royce motors undoubtedly were, to a very great extent, responsible for the success of the flight.

BOLSHEVISM by degrees is becoming quite "civilised" in its up-to-date methods of carrying on its ghastly creed. A special corps of aviators is being organised by the Budapest Bolshies for the purpose of distributing propaganda leaflets among the populations of the adjoining countries

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JOY-FLYING appears to be quite the vogue in political circles in America. From Washington comes a despatch that it is so popular that Congress Party leaders, fearful of casualties amongst their respective followers who are indulging in this very fascinating recreation, are demanding the adoption of a pairing system in arranging flights. In other words, the Republican leaders want an understanding that every time a Republican senator is taken up in the air one or more Democratic senators must be taken up too. This keenness may well be, as the Republican margin of control in the Senate is only two votes. A casualty or two among the Republican senatorial airmen followed by the appointment of a Democratic successor, as might happen in several cases, would upset their control and place the machinery back in the hands of the Democrats despite the results of the last election.

ANOTHER phase of the passion for flying which is asserting itself in New York finds expression in an air-ball arranged by New York women, to be given at the Ritz-Carlton Hotel on April 26 under the chairmanship of Mrs. W. K. Vanderbilt, Junr. It should be some function, as 35,000 invitations have, it is stated, been issued. A feature is to be the attendance of a number of pilots who will arrive by air. As the affair is to benefit the Air Service Memorial Funds, everyone will no doubt wish it a big success.

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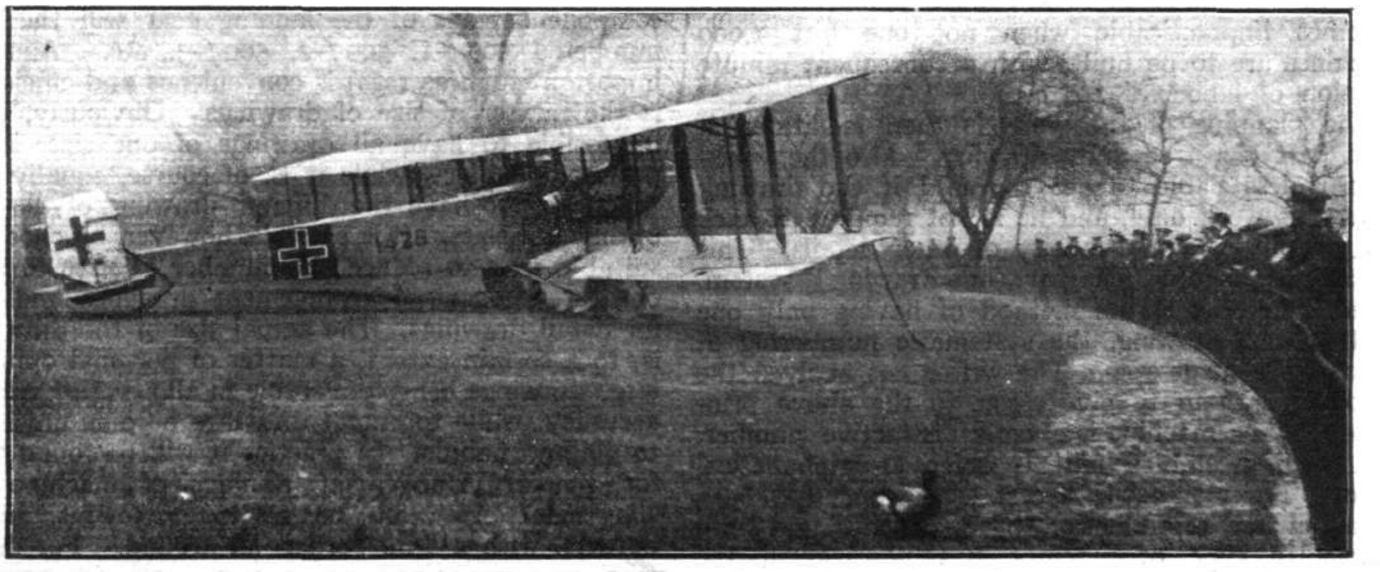
AGAIN from America comes the news that the Kerr Steamship Company of Philadelphia has purchased a fleet of aeroplanes for commercial purposes, to be used in active service as auxiliaries to the company's merchant steamers. It is stated that the type selected is the "Christmas Bullet," recently described in FLIGHT. The idea is that when placed in service, these aeroplanes will overtake ships 24 to 36 hours after the vessels have left port, and will deliver delayed consignments and papers. Steamers' time in port thus may be reduced by upwards of a day.

The Kerr steamship line operates cargo ships from New York, Boston, Philadelphia, New Orleans, and Galveston to the principal European ports and Dutch Indies.



"*NOT* A CASE OF BIRDS OF A FEATHER," etc.—The "bird" in the background is a captured German bomber now exhibited *sans* engine in St. James's Park. The flyer in the foreground is of a much more peaceful character, and hails, we believe, from China.

DRAWING OFFICE DATA*

By E. O. WILLIAMS, B.Sc.Eng. (Lond.), Assoc. M. Inst. Civil Engineers, Assoc. Fellow R.Ae.Soc.G.B.

[*With the growth of the aviation industry the need for methodisation becomes increasingly important—methodisation in design and construction as well as in manufacture. With regard to the two first mentioned, as experience is extended the volume grows of data relating to construction and design, and unless a proper system is evolved for preserving and collating in suitable form such data, it is almost inevitable that confusion will ensue, or at any rate that full advantage cannot be taken of the experience and data collected in the past for the benefit of the future. Often it will be found that the work involved will be somewhat heavy, especially as regards design, but it will be found to pay " in the long-run." There is as yet a long way before we arrive at anything approaching standardisation, hence the number of lengthy calculations involved every time a new design is contemplated is prodigious. So long as each new machine differs to any considerable extent from the previous one—and at present this would appear to be the case—all the calculations, aerodynamic as well as structural, have to be gone through afresh. It is not always possible to generalise owing to the difference in shape, size and material of component parts, but much may be done in this direction by making from the start calculations for all such sizes and shapes as may be reasonably expected to come useful for the next series of designs.*

It is particularly in this anticipation of the next requirements and in the methodical way of presenting them that the series of articles by Mr. E. O. Williams, of which the first is published this week, are useful. The articles do not, except in one or two instances, introduce anything not already pretty generally known, nor do we think that the author lays claim to disclosing any new discoveries in the bulk of the subjects treated. The articles are, however, the outcome of an attempt to methodise the daily routine of the drawing office, and, given time, *the tabulation of the various calculations would possibly occur to anyone. It is, however, just in this saving of time that these articles will, we feel sure, be found of great assistance. In regard to the tables, graphs, etc., it has not been possible, for reasons connected with publication, to make these all of a uniform size, but so far as has been possible we have endeavoured to do so, so that in the majority of cases readers who wish to do so will be able to tear out these pages and keep them in a loose-leaf pocket-book for easy reference. We regret that since writing this series of articles Mr. Williams has left the aviation industry and has turned his attention to a different branch of engineering. He is now devoting his energies to the restoration of our depleted tonnage—certainly a task of as vital importance as that of building aircraft—but we hope that some day he may be persuaded to return to the aviation world. With these few words of introduction, we will leave our readers to the tender mercies of Mr. Williams.*—ED.]

I.—DRAWING OFFICE SYSTEM.

(a) *System of Numbering Drawings.*

THE successful production of complex repetition work, such as the aeroplane, is to a very great extent dependent on the efficiency of the drawing office. Errors in design or draughtsmanship are obviously fatal, but even if the general design is sound, there yet remains a great deal to be done in the drawing office, the quality of which goes a very long way towards making or marring the machine. When, as in pre-War days, only one or two machines of a new type were to be built, the drawings required were, of course, entirely different from those demanded when it comes to orders for large numbers, especially when parts or even complete machines are to be constructed at works other than those of the original designers.

If only one machine were to be built, it would probably be convenient to mass together on one sheet the drawings for all the details referring to a complete unit such as the *fuselage*. For example, the *fuselage* drawing would then contain all details such as sizes of *longerons*, struts, wiring, cockpit, seating, padding, cowling, etc., and all trades would refer to the one sheet of drawings. This procedure becomes impracticable when not one but 1,000 machines are to be built, with a consequent minute division of labour.

The planning of the work is then facilitated if each part has a separate drawing. Also the workman is less liable to get confused if the drawing shows his work only, and he is not required to pick his job out of a multiplicity of other details. This is the basis of the " one part, one drawing " system.

Important as is the method of having only one part on one drawing, the systematic numbering of drawings is no less so. The writer has evolved the following system to give effect to the above principles: Each machine is given a distinctive number, and each assembled unit is given an alphabetical letter. For instance: A certain machine has been accepted for reproduction in quantities, and that particular type of machine has been given the works number 500. Then all sheets and drawings referring to this particular type will be provided with, firstly, the general number 500, and, secondly, with an alphabetical letter following the number and indicating to what part of the machine the drawing refers. The letter to follow the general number will depend on what system is chosen, and is not, perhaps, so very important so long as the particular system, once decided upon, is rigidly adhered to. The following lettering of drawings will, I think, be found convenient in practice:—

General arrangement of complete machine	*a*	Engine mountings and cowling ...	*j*
Fuselage	*b*	External wiring ...	*k*
Wings	*c*	External struts ...	*l*
Tail plane and elevator	*d*	Controls	*m*
Rudder and fin ...	*e*	Engine controls ...	*n*
Landing gear ...	*f*	Instrument board ...	*p*
Tail skid	*g*	Accessories	*q*
Tanks	*h*	Parts lists	*r*
		Stress diagrams ...	*s*

For example, if the general number of the machine is 500, the drawing of the landing gear will be numbered 500*f*. Detail drawings of the various component parts of the landing gear will then be numbered 500*f*–1, 500*f*–2, 500*f*–3, etc. Another important item as regards convenience and efficiency is the matter of size of drawings. Obviously, it is impossible to have all drawings of one size, irrespective of subject, while it is, of course, equally impracticable to have the different drawings of all sorts of different sizes. It is possible, however, by choosing suitable sizes to reduce the number of sizes to two, one for the general arrangement drawings and one for detail drawings. The actual size of the drawings is, to a certain extent, a matter of personal opinion, large drawings being preferable in allowing of greater accuracy, while too great drawings become unwieldy to file and handle. In practice it will be found that for general arrangement tracings of machines, a convenient size will be 27 ins. × 50 ins. inside borders, with a ¾-in. border all around. For detail tracings, a good size is 28 ins. × 36 ins. inside borders, with a ¾-in. border all around. It will be found convenient to divide up the detail tracings as required to a standard size of 13½ ins. × 9 ins., or

* This article, which was written some time ago, has not been released for publication until recently. It has not, however, lost in interest during the interval.

NAME OF FIRM.

PARTS LIST.

P

TYPE OF MACHINE . . . . . . CONTRACT Nº . . . . . .

UNIT . . . . . . WORKS JOB Nº . . . . .

Description of Part	Drg. Nº	Part Nº	No. reqd per unit	Total No. required	Specification of Material	Where made	Remarks.

Prepared by . . . Checked by . . . . Date . . . . . Sheet Nº . . . of . . . Sheets.

FIG. 1.

NAME OF FIRM.

MATERIAL LIST.

M

TYPE OF MACHINE . . . . CONTRACT Nº . . . .

UNIT . . . . . . Nº OFF . . . . . . WORKS JOB Nº . . . .

Quantity	Material	Specification	Required for	Date reqd.	Shop	Remarks

Prepared by . . . . Checked by . . . . Date . . . . Sheet Nº . . . of . . . . Sheets.

FIG. 2.

NAME OF FIRM.

REQUISITION LIST.

R

TYPE OF MACHINE . . . . . . CONTRACT Nº . . . .

UNIT	Nº OFF	WORKS JOB Nº	UNIT	Nº OFF	WORKS JOB Nº.

Material	Total Quantity required	Quantity available in store (Date . . .)	Quantity to be ordered	Works order Nº	Date ordered by Works	Date order placed	Order placed with	Delivery promised	When received	Remarks

Prepared by . . . . . Checked by . . . . Date . . . . Sheet Nº . . . of . . . . Sheets.

FIG. 3.

multiple thereof, thus dividing up the detail tracing sheet into not more than eight parts. The G.A. tracings should have the full stencil in the bottom right-hand corner, while the detail tracings should have the drawing number and sheet number in the bottom right-hand corner. All other tracings should have the full stencil in the bottom right-hand corner.

Tracers should, of course, be held responsible for their work, and should satisfy themselves that their tracings are accurate copies before handing them in. They should also see that all particulars, such as drawing numbers, etc., are on their tracings. As regards checking of tracings, this should be done by the draughtsman responsible for the drawing traced.

(b).—*Preparation of Parts Lists, Materials Lists, and Requisition Lists.*

It is of vital importance to the speed and economy of a contract that all materials be ordered at the earliest. To omit to order the most trifling detail usually results in serious delay in completing a machine. To avoid this, it is necessary to adopt some systematic listing of parts and materials, and it is suggested that the listing is most conveniently and reliably effected in the drawing office responsible for the original design.

(i) *Parts Lists.*—The first operation is to make a list of every part of the machine on a standard form, such as is shown in Fig. 1. This list enables the works office to place out the operations either in the works, or with sub-contractors, in a systematic manner.

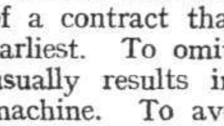
(ii) *Materials Lists.*—From the completed parts lists the Materials Lists are abstracted on to forms such as shown in Fig. 2. This form assists the works office in apportioning the material as it arrives, and also informs each foreman what material he will require.

(iii) *Requisition Lists.*—The Materials Lists would not be a satisfactory means of communicating requirements to the buying department. Items for similar materials repeat over and over again in the materials lists. For this reason it is necessary to collect in one list, termed the Requisition List, all the requirements of each material required for the contract. For instance, in the Materials Lists 18 gauge plate may occur several times, a few feet here and a few feet there. The object of the Requisition List would be to collect all the requirements of 18 gauge plate in one item, as that is what the buying department would need when ordering.

II.—STANDARDISED DETAILS.

(a).—*Standard Metal Lugs to take A.G.S. Tie-rods and Stream-line Wires.*

In the earlier days of the War there was naturally some confusion caused by the absence of any particular specified standards to which to work, the R.A.F. having one standard, the Admiralty another, etc. Now, however, this difficulty has been settled by the universal adoption of what is known as the A.G.S. standard, to which all work executed for the Government has to be made. Under this arrangement standard sizes have been laid down for such details as bolts, nuts, screws, studs, strainers, etc. In the case of A.G.S. fork ends and universal fork



Standard A.G.S. Fork end

joints, these are so proportioned as to give a certain specified strength, and for maximum efficiency the wiring plates or lugs connecting the fork ends to the spars, struts, etc., should have strengths not less than the specified strengths of the fork joints.

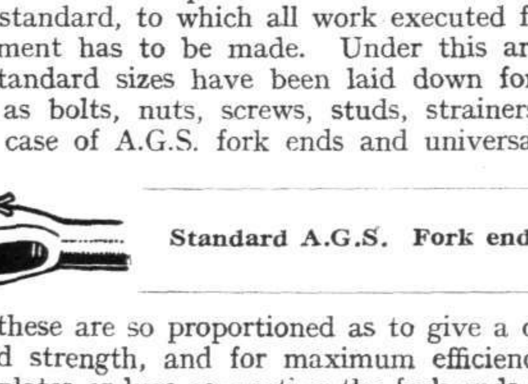


Fig. 4

Each A.G.S. fork end has a given size of pin. For instance, the $\frac{5}{16}$-in. A.G.S. fork joint has a pin of $\frac{11}{32}$-in. diameter. The load from the fork joint is transferred to the lug by the bearing pressure of the pin on the metal part of the lug surrounding the pin. The intensity of bearing pressure must not exceed a certain limit fixed by the quality of the material of which the lug is made. For 26-ton mild steel plate, the maximum allowable bearing pressure should not exceed 35 tons per square inch of the projected area of the pin in contact with the plate.

Let f_b be the allowable intensity of bearing pressure in tons per square inch, t inch (*see* Fig. 4) be the thickness of the lug, d'' be the diameter of the pin, then strength of lug as limited by bearing pressure $= f_b \times t \times d$ tons. Let F be specified strength of fork end in tons per square inch, then $f_b \times t \times d$ should equal or be greater than F. The diameter of pin, d'', is fixed by the A.G.S. standard design. $\therefore t = \dfrac{F}{f_b \times d}$

Example: The $\frac{5}{16}$ in. A.G.S. fork joint has a strength of 5,700 lbs. $= 2 \cdot 53$ tons, and the diameter of its pin is $\frac{11}{32}$ in. $= \cdot 3425$ in. $\therefore t = \dfrac{2 \cdot 53}{35 \times \cdot 3425}$ $= \cdot 21$ in. This dimension of t is a minimum and $\cdot 01$ in. should be allowed for variation in the thickness of the plate from which the lug is cut. It should be noted that this required thickness t should be made up of washers if the thickness of the plate itself is insufficient, as will sometimes be the case where it is desired to keep the rest of the fitting a lighter gauge than that required for the lug portion.

The bearing pressure tends to shear out a portion of the head of the lug, as shown in Fig. 4, and this is provided against by making the dimension "y" sufficient. Although it appears that the sheared portion of the head of the lug requires two sections of the lug to shear before it fails, it is customary to assume that only $1\frac{1}{2}$ sections of lug resist the shear. This is to allow for the tearing tendency in the head of the lug which makes pure double shear impossible.

Let f_s = shearing strength of the lug material, in this case = 20 tons for 26-ton mild steel plate, then $1 \cdot 5 f_s \times t \times y$ = shearing strength of head of lug, which must be equal to or greater than F; "t"

FLIGHT

A.C.S. No. Fork Ends for Tie Rods & R.A.F Wire	A.C.S. No. Fork Ends to Strainers	A.C.S. No. Universal Fork Joints	Designation	Strength in LBS	Diameter of Pin	Width Between Forks	Total Thickness "t" Including any Washers	Radius "R" Inches	Offset "d" Inches	Cross Sectional Area "A" Sq Inches
167	138-9	332	6 B.A.							
168	140	333	4 BA	1,050	5/32"	·10	·085	·19	·04	·018
169	141-2	334	2 BA	1,900	3/16"	·15	·130	·23	·07	·033
170	143-4	335	1/4" B.S.F	3,460	1/4"	·20	·180	·30	·08	·060
171	145-6	336	9/32" "	4,650	9/32"	·20	·190	·36	·13	·081
172	147	337	5/16" "	5,700	11/32"	·25	·220	·42	·14	·099
173	148	338	11/32" "	7,150	11/32"	·25	·240	·42	·14	·123
174	149	339	3/8" "	8,500	13/32"	·30	·270	·48	·15	·147
175		340	13/32" "	10,250	7/16"	·34	·310	·51	·22	·177
176		341	7/16" "	11,800	15/32"	·36	·330	·55	·24	·204
177		342	15/32" "	13,800	1/2"	·38	·355	·59	·25	·238
178		343	1/2" "	15,500	17/32"	·40	·375	·63	·27	·267

STANDARD LUGS FOR ÷

A.C.S. FORK ENDS TO TIE RODS & R.A.F WIRES

Do FORK ENDS TO STRAINERS

Do UNIVERSAL FORK JOINTS TO R.A.F WIRES.

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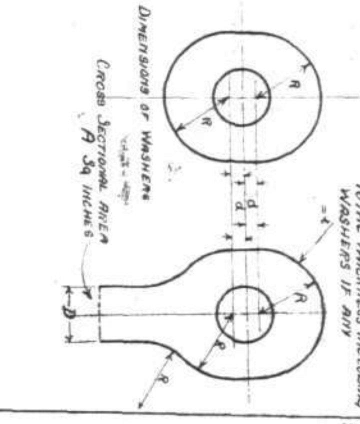

NOTE: WASHERS ARE TO BE SAME DIMENSIONS AS EYE, OF SAME MATERIAL, & BRAZED TO EYE.

MATERIAL OF LUGS IS 26 TON H.S.P R.A.F. SPEC. 9A

TO OBTAIN DIMENSION "D" DIVIDE AREA "A" IN FOLLOWING TABLE BY TOTAL THICKNESS OF METAL AT THAT POINT

Fig. 5.

FLIGHT

A.C.S. No. of Bolts Nuts Screws and Studs

Designation	Bolts etc: Hexagonal Bolts	Eye Bolts	Studs	Round Headed Screws	Cheese Headed Screws	Countersunk Screws	Nuts: Ordinary Nuts	Thin Nuts Left	Thin Nuts Right	Slotted Nuts	Castle Nuts	Wing Nuts
6 B.A.	101			244	246	248	115 D					113 A
4 B A	102			245	247	249	115 C					113 B
2 B.A	103	122	130				115 B			114		113 C
1/4 B.S.F	105	123	131				116 A	239 A	117 A	118 A	119 A	120 A
9/32 B.S.F	106						116 B	239 B	117 B	118 B	119 B	120 B
5/16 B.S.F	107	124	132				116 C	239 C	117 C	118 C	119 C	120 C
11/32 B.S.F	108						116 D	239 D	117 D	118 D	119 D	120 D
3/8 B.S.F	109	125	133				116 E	239 E	117 E	118 E	119 E	120 E
13/32 B.S.F	110						116 F	239 F	117 F	118 F	119 F	120 F
7/16 B.S.F	111						116 G	239 G	117 G	118 G	119 G	120 G
15/32 B.S.F								239 I	117 I			
1/2 B.S.F	112						116 H	239 H	117 H	118 H	119 H	120 H

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Fig. 6.

has already been fixed by bearing pressure, hence "y" is determinable.

Example: For $\frac{5}{16}$ in. A.G.S. fork end F = 5,700 lbs. = 2·53 tons; t = ·22 in., then $1 \cdot 5 \times 20 \times \cdot 22 \times y = 2 \cdot 53$.

$$\therefore y = \frac{2 \cdot 53}{1 \cdot 5 \times 20 \times \cdot 22} = \cdot 385 \text{ in., say } \cdot 39 \text{ in.}$$

The next critical sections to be considered are x and x at the sides of the lug. These two areas added together must have a tensile strength equal to or greater than the specified strength of the fork joint. Let f_t be the tensile strength of lug material = 26 tons per square inch for 26-ton mild steel plate, then $2 \times x \times t \times f_t$ must be equal to or greater than F. For example, for a $\frac{5}{16}$-in. A.G.S. fork end $2 \times x \times \cdot 22 \times 26 = 2 \cdot 53$ tons. $\therefore x = \dfrac{2 \cdot 53}{2 \times \cdot 22 \times 26} = \cdot 22$ in. Actually, x should be made slightly greater than this to allow for eccentric loading when the eye of the lug is not exactly in the centre of the lug. The accompanying table (Fig. 5) has been calculated on the above assumptions.

(b).—*Strength of A.G.S. Standard Bolts in Direct Shear, Direct Tension, and Combined Shear and Tension.*

In designing many of the fittings of an aeroplane it becomes necessary, in order to provide the requisite factor of safety, to know the strength of the bolt or bolts holding down the particular fitting. In a few cases only are the stresses to which the bolts are subjected either direct tension stresses or direct shear stresses; more often a combination of the two is met with. To the average draughtsman it is sometimes a matter of some difficulty to determine how much to allow for one kind of stress and how much for the other, and in all cases a fair amount of calculations are necessary, which, it is hoped, the accompanying tables and charts may prove helpful in reducing to a minimum.

Two of the accompanying tables (Figs. 6 and 7) give the A.G.S. numbers of bolts, nuts, screws and studs, and the dimensions of A.G.S. bolts, boltheads, and nuts respectively, while a third table, Fig. 8, gives the ultimate tensile and shearing values for all A.G.S. bolts, both on full area and on core area. In the cases of direct shear and direct tension the values are obtained by multiplying the ultimate shearing or tensile stress by the area considered.

In Fig. 8, cases I, II and III give the strength values for the bolts when the pull on the bolt is inclined at 45 deg.

CASE I.—It is assumed that a strut takes all the component of the load acting along the axis of the bolt; that is to say, that there is no tension on the bolt, but only pure shear. Assuming that the bolt is nutted up on the opposite side of the beam (as should always be done), the shear is taken by the full area of the bolt. In this case the allowable inclined pull equals $\sqrt{2}$ times the allowable shearing force acting at right angles to the axis of the bolt.

CASE II.—It is assumed that the lug putting the inclined load on the bolt is carried beyond the bolt, and is anchored on several more bolts, so that the shear per bolt is negligible. In this case the stress on the bolt is purely tensional, and the allowable inclined pull is equal to $\sqrt{2}$ times the allowable direct tension measured on the core area.

CASE III.—This case assumes that both components of the inclined pull are taken on one bolt, and this probably represents the most usual practical problem. The combined tension and shear occur at the headed end of the bolt, that is, they are resisted by the full area of the shank of the bolt. At the nutted end of the bolt there is no shear, and the allowable inclined pull, as fixed by the core area at this end, is the same as in Case II.

It now becomes a question whether the allowable inclined pull as fixed by the combined stress in the shank is greater or less than the allowable inclined pull as fixed by the tension in the core area. Of course, the lesser of the inclined pulls is the one required.

In the column under Case III, the inclined pulls, as fixed by the combined stress in the shanks, are given. For 6BA and 4BA bolts, these are greater than the pulls given under Case II, and the latter and lesser values must be taken. For the other sizes of bolts the ultimate inclined pulls are fixed by the stresses in the shank, which goes to show the efficiency of the bolts.

The combined stresses in the shank of the bolt are obtained as follows:—

Let F be inclined pull,
F_t be tensile component,
F_s be shearing component.

Since F is inclined at 45 deg., $F_t = F_s = \dfrac{F}{\sqrt{2}}$

Let A be the area of the shank, then tensile or shearing stress on axis or at right angles to axis of bolt respectively $= \dfrac{F}{\sqrt{2} \times A}$

The principal tensile stress

$$= \tfrac{1}{2} \frac{F}{\sqrt{2} \times A} + \sqrt{\frac{F^2}{4 \times 2 \times A^2} + \frac{F}{2 \times A^2}}$$

The principal shearing stress

$$= \sqrt{\frac{F^2}{4 \times 2 \times A^2} + \frac{F^2}{2 \times A}}$$

If principal tensile stress is limited to 35 tons/square inch—

$$35 = \frac{F}{A \times 2\sqrt{2}} + \frac{\sqrt{5} \times F}{A \times 2\sqrt{2}}$$

$$\therefore F = \frac{35A \times 2\sqrt{2}}{1 + \sqrt{5}}$$

$$= \frac{70A\sqrt{2}}{1 + \sqrt{5}} = 30 \cdot 6A.$$

If principal shearing stress is limited to 25 tons/square inch—

$$25 = \sqrt{\frac{F^2}{4 \times 2 \times A^2} + \frac{F^2}{2 \times A^2}} = \frac{\sqrt{5} \times F}{A \times 2\sqrt{2}}$$

$$\therefore F = \frac{25 \times A \times 2\sqrt{2}}{\sqrt{5}} = \frac{50A\sqrt{2}}{\sqrt{5}} = 31 \cdot 5A.$$

From this it is seen that the principal tensile stress is critical.

Example: $\frac{1}{4}$-in. B.S.F.

Full area = ·0491 sq. in. F = 30·6 × ·0491 tons = 3,400 lbs.

On the accompanying chart, Fig. 9, the ultimate inclined pulls at any angle of pull are given. The strengths of the bolts are plotted on a system of polar co-ordinates. Distances along radial lines

FLIGHT

DIMENSIONS OF A.G.S BOLTS BOLTHEADS AND NUTS

DESIGNATION	DIAMETER OF BOLT		CORE DIAMETER		GROSS SECTIONAL AREA AT BOTTOM OF THREAD		DIMENSIONS OF NUTS AND BOLTHEADS IN INCHES			THICKNESS OF NUTS IN INCHES				THICKNESS OF BOLTHEADS IN INCHES		NUMBER OF THREADS PER INCH
							WIDTH ACROSS FLATS		WIDTH ACROSS CORNERS	ORDINARY		THIN				
	M/M	INCHES	M/M	INCHES	SQUARE M/M	SQUARE INCHES	MAX	MIN	APPROX MAX	MAX	MIN	MAX	MIN	MAX	MIN	
6 BA	2 8	·11	2 16	·085	3 66	·0057	·280	·275	·323	·13	·12			·13	·12	·53 M/M PITCH
4 B.A.	3·6	·142	2·81	·111	6·20	·0096	·280	·275	·323	·16	·15			·13	·12	·66 M/M PITCH
2 BA	4 7	·185	3·73	·147	10·93	·017	·338	·333	·390	·19	·18			·13	·12	·81 M/M PITCH
	INCHES		INCHES		SQUARE INCHES											
1/4 BSF	1/4	·25	·1988		·0310		·445	·440	·52	·21	·20	·16	·15	·16	·15	26
9/32 BSF	9/32	·281					·525	·520	·61	·26	·25	·18	·17	·23	·22	26
5/16 B.SF	5/16	·3125	·2543		·0508		·525	·520	·61	·26	·25	·20	·19	·23	·22	22
11/32 BSF	11/32	·344					·600	·595	·69	·32	·31	·22	·21	·28	·27	22
3/8 BSF	3/8	·375	·3110		·0760		·600	·595	·69	·32	·31	·24	·23	·28	·27	20
13/32 BSF	13/32	·406					·710	·705	·82	·39	·38	·26	·25	·34	·33	20
7/16 BSF	7/16	·4375	·3664		·1054		·710	·705	·82	·39	·38	·28	·27	·34	·33	18
15/32 BSF	15/32	·469					·710	·705	·82			·28	·27			
1/2 BSF	1/2	·5	·4200		·1385		·820	·815	·95	·45	·44	·32	·31	·39	·38	16

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Fig. 7.

FLIGHT

ULTIMATE STRENGTH OF STEEL

BOLTS IN POUNDS

ULTIMATE STRENGTH OF STEEL BOLTS IN POUNDS SPECIFICATION R.A.F 3A ULTIMATE TENSILE STRESS 35 TONS PER SQUARE INCH
SHEAR - 25 -

SIZE	CORE AREA IN SQUARE INCHES	FULL AREA IN SQUARE INCHES	ULTIMATE DIRECT SHEAR		ULTIMATE DIRECT TENSION		ULTIMATE TENSION INCLINED AT 45° TO BOLT		
			ON CORE AREA	ON FULL AREA	ON CORE AREA	ON FULL AREA	CASE I PRODUCING SHEAR ONLY ON BOLT (FULL AREA CONSIDERED)	CASE II PRODUCING TENSION ONLY ON BOLT (CORE AREA CONSIDERED)	CASE III COMBINED TENSION AND SHEAR (FULL AREA CONSIDERED)
6 BA	·0057	·0096	319	537	446	·753	760	631	...
4 BA	·0096	·01582	531	886	752	1,240	1,252	1,063	
2 BA	·017	02685	952	1,503	1331	2,105	2,125	1,882	1,850
1/4 BSF	·031	·0491	1,735	2,750	2,430	3850	3,890	3,440	3,400
9/32 BSF		·062		3,470		4,860	4,905		4,280
5/16 BSF	·0508	·0767	2,844	4,295	3980	6,010	6,075	5,635	5,300
11/32 BSF		·0928		5200		7,280	7,350		6,400
3/8 BSF	076	·1103	4,254	6175	5,955	8,655	8,740	8,440	7,650
13/32 BSF		·1293		7,295		10,130	10,235		8,950
7/16 BSF	·1054	·1502	5,800	8415	8,270	11,790	11,900	11,700	10,400
15/32 BSF		·173		9690		13,570	13,700		12,000
1/2 BSF	·1385	·1961	7,750	10,990	10,840	15,390	15,540	15,340	13,600

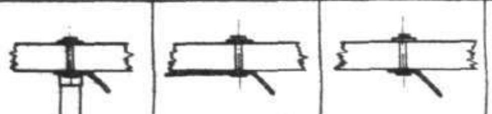

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Fig. 8.

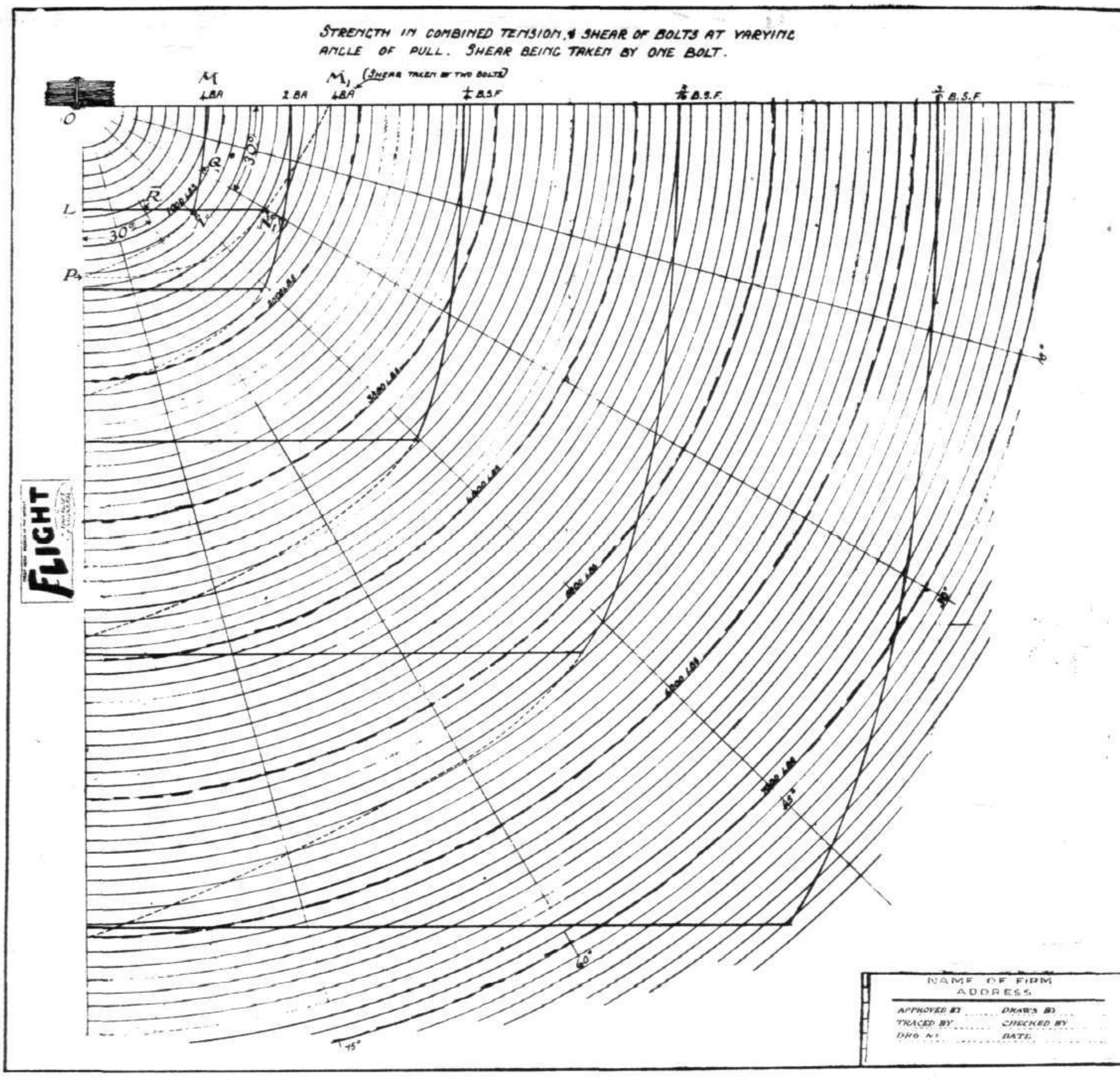

Fig. 9

measure lbs. of inclined pull, and the angles of the radiating lines correspond with the angles of pull. First, the curve MNP is plotted, which gives the allowable inclined pulls as limited by the combined stresses in the shank. That is, OM is the direct shearing value of the shank, and OP is the direct tensile value of the shank. Again, LRN is plotted, which gives the allowable variation in inclined pull as fixed by the core area of the threaded portion of the bolt. The two curves cross at N, at which point the limit, as fixed by the shank, coincides with the value fixed by the core area.

For example, at 30 deg. from the horizontal, the allowable inclined pull on a 4 B.A. bolt is OQ lbs., which equals 950 lbs. At 30 deg. from the vertical the limit is OR, which equals 850 lbs. Thus, if the value of the inclined pull is known, and its angle of inclination, the apprcpriate standard bolt to attach the lug to the spar or strut is immediately determinable from this chart.

In certain cases the lug may be attached to the spar by two bolts, so that the shearing component of the inclined pull comes on both bolts, but all the tensional component on one. In this case the limiting inclined pull as fixed by the shank is greater. For a 4 B.A. bolt the revised curve of inclined strength is given by LN_1M_1. It would hardly be practicable to rely too much on this latter case, owing to the difficulty in so fitting two bolts that each takes half of the shearing force. The really practical parts of the curves are in full lines.

This chart shows that the maximum allowable inclined pull is at about 45 deg., and that then the limits as fixed by shank and core are equal. Thus the excess of area in the shank is in itself no inefficient use of material, apart from other practical questions which render it necessary.

(*To be continued.*)

Aerial Insurance

Now that the question of insurance of machines, passengers, pilots, goods, etc., is so very much to the fore, we shall be pleased to receive enquiries from companies or individuals interested in the subject, with a view to arranging rates, etc., under Lloyd's policies. Enquiries should be addressed to F. King, Manager, Aerial Insurance Department, 36, Great Queen Street, Kingsway, W.C. 2, who is in a position to quote the lowest market rates.

THE ROYAL AIR FORCE

London Gazette, April 8

The following temporary appointment is made :—

Staff Officer, 3rd Class (T.).—J. B. Walker (Temp. Capt., R.E.), and is granted a temp. commn. as Capt.; April 1, 1918.

The following temporary appointments are made :—

Staff Officer, 1st Class (T.).—Capt. (actg. Lieut.-Col.) H. A. P. Disney, and to retain the actg. rank of Lieut.-Col. whilst so employed; Jan. 28 to March 31.

Staff Officers, 2nd Class (P.).—Maj. G. R. Moser; Feb. 14 to March 4. Capt. (actg. Maj.) W. J. C. Kendall, and to retain the actg. rank of Maj. whilst so employed; March 5.

Staff Officers, 3rd Class.—And to be actg. Capts. whilst so employed, if not already holding that rank :—(P.)—Sec. Lieut. (actg. Lieut.) R. Wight; Feb. 14. Lieut. J. A. W. Bourne; Feb. 18. Capt. N. Robertson; Feb. 19.

Flying Branch

Lieut.-Cols. to be Lieut.-Cols. (A.) :—(Actg. Brig.-Genl.) F. V. Holt, C.M.G., D.S.O., and relinquishes the actg. rank of Brig.-Genl.; April 1. C. H. K. Edmonds, D.S.O., O.B.E., from (S.O.); April 1. R. Williams, D.S.O. (Lieut.-Col., Aus. F.C.), is granted a temp. commn. as Lieut.-Col. (A.); June 28, 1918. Capt. H. Meintjes, M.C., to be actg. Maj. whilst employed as Maj. (A.); Oct. 1, 1918. Capt. G. Donald, D.F.C., to be actg. Maj. whilst employed as Maj. (A. and S.); Aug. 30, 1918. Capt. W. J. de Salis, D.S.C., to be graded for pay as Capt. whilst employed as Capt. (A. and S.); Aug. 8, 1918. Lieut. (actg. Capt.) J. W. D. Leigh, M.C., retains the actg. rank of Capt. whilst employed as Capt. (A.) from (T.); March 31. Lieut. E. A. Coghlan to be actg. Capt. whilst employed as Capt. (A.); Dec. 1, 1918. Lieut. (Hon. Capt.) R. Lindsay to be actg. Capt. whilst employed as Capt. (O.); Sept. 26, 1918. Sec. Lieut. H. Jones (late Gen. List, R.F.C., on prob.) is confirmed in his rank as Sec. Lieut. (A.); Oct. 27, 1918. A. A. McConnell, M.C. (Temp. Lieut., Durh. L.I.) is granted a temp. commn. as Sec. Lieut. (Obs. Officer), and to be Hon. Lieut.; Oct. 25, 1918. Flt. Cadet 178057 D. C. Pollock is granted a temp. commn. as Sec. Lieut. (Obs. Officer); Oct. 31, 1918.

The following relinquish their commns. on ceasing to be employed :—Lieut. F. C. Higgins (Lieut., Can. F.A.); Jan. 1. Lieut. R. G. Atkinson (Lieut., Quebec R.); Jan. 31. Sec. Lieut. H. Walker (Sec. Lieut., Manc. R.); Feb. 24. Lieut. J. F. White (Lieut., C. Ont. R.); Feb. 26. Lieut. J. B. Case (Lieut., I.A.R.O.); Feb. 27. Sec. Lieut. W. J. Goddard (Sec. Lieut., M.G.C.), Sec. Lieut. (Hon. Lieut.) J. B. Hutcheson (Lieut., Sask. R.); March 6. Sec. Lieut. (Hon. Lieut.) R. E. Davidson (Lieut., Can. F.A.); March 14. Lieut. H. M. Thomas (Lieut., B. Col. R.); March 21.

Then follow the names of 207 officers who are transfd. to the Unemployed List under various dates. (We regret that owing to the great pressure on our space it is impossible to reprint this portion of the list.—ED.)

Sec. Lieut. E. J. N. Finlayson is dismissed the Service by sentence of a General Court-Martial; Dec. 25, 1918.

The following Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank :—G. Bryer-Ash (Wilts. R.) (contracted on active service), J. Kyle (contracted on active service), D. W. Lees (caused by wounds), R. G. Pratt, E. H. Penberthy (Lond. R., T.F.); April 9.

The following Lieuts. relinquish their commns. on account of ill-health :—A. R. Mann (R.F.A., S.R.) (contracted on active service), S. D. Morrison (Nova Sco. R.); April 9.

The following Sec. Lieuts. relinquish their commns. on account of ill-health contracted on active service, and are permitted to retain their rank : H. E. Light, C. W. Mann, G. R. Newton-Bridle, L. C. Roberts; April 9.

The surname of Lieut. (actg. Capt.) H. V. Robins, M.C., is as now described, and not as stated in the *Gazette* of July 12, 1918.

The Christian name of Sec. Lieut. Harry Holsten Wilson is as now described, and not as stated in *Gazette* Sept. 6, 1918.

The Christian names of Sec. Lieut. Gabriel John Erasmus Boyd are as now described, and not as stated in *Gazette* Nov. 22, 1918.

The initials of Lieut. (actg. Capt.) F. D. Grant are as now described, and not as stated in *Gazette* Dec. 6, 1918.

The notification in *Gazette* Aug. 20, 1918, concerning Lieut. A. Sattin is cancelled.

The notification in *Gazette* Jan. 21 concerning Lieut. T. Stewart (E. Ont. R.) is cancelled.

The notification in *Gazette* Feb. 14 concerning Sec. Lieut. S. A. Pindar is cancelled.

The surname of Lieut. (Hon. Maj.) E. C. Carver, D.S.O., is as now described, and not Carner, as stated in *Gazette* March 18.

Administrative Branch

Capt. A. M. Wilson to be actg. Maj. whilst employed as Maj.; June 12, 1918.

Lieuts. to be actg. Capts. whilst employed as Capts. :—C. H. Young; July 1, 1918. (Hon. Capt.) J. F. C. Bennett; Nov. 1, 1918. C. R. R. Gidney, (Hon. Capt.) F. C. McBride; Dec. 1, 1918.

Capt. C. D. Smart, M.C., to be Lieut., from (A.), and to be Hon. Capt.; June 3, 1918 (substituted for notification in *Gazette*, Feb. 14).

Lieuts. (A.) to be Lieuts. :—A. Holden; March 4. H. I. Pole; March 15.

Lieuts. (K.B.) to be Lieuts. :—R. G. C. Pinfield; Nov. 1, 1918. H. F. Barnes, M.C.; March 6.

C. F. Morris (Capt. and Qrmr., Spec. List) is granted a temp. commn. as Lieut.; April 1, 1918, and to be Hon. Capt. (substituted for notification in *Gazette* Feb. 14).

Sec. Lieut. H. J. Challis to be Sec. Lieut., from (A. and S.); Nov. 26, 1918.

Sec. Lieut. F. R. Stewart (late Gen. List, R.F.C., on prob.) is confirmed in his rank as Sec. Lieut.; March 3.

N. Bucknall is granted a temp. commn. as Sec. Lieut.; March 25.

The following relinquish their commns. on ceasing to be employed :—Lieut. R. N. D'O. Earwaker (Lieut., Man. R.); Feb. 12. Lieut. J. A. Clarke (R.A.); Feb. 22. Lieut. W. MacDonald (Lieut., R.W. Surr. R.); March 13.

Then follow the names of 52 officers who are transfd. to the Unemployed List under various dates.

Lieut. (actg. Capt.) F. M. Drake relinquishes his commn. on account of ill-health, and is permitted to retain the rank of Capt.; April 9.

Lieut. A. J. Bird relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; April 9.

Sec. Lieut. H. G. Booth resigns his commn.; April 9.

The initial of Capt. J. Williams is as now described, and not as stated in *Gazette* March 14.

The surname of Sec. Lieut. J. Earle-Willson is as now described, and not as stated in *Gazette* March 25.

The notification in *Gazette* of Nov. 1, 1918, concerning Lieut. P. J. Harris is cancelled.

The notification in *Gazette* of March 21 concerning Sec. Lieut. R. C. Dickinson is cancelled.

Technical Branch

Lieut.-Col. A. V. Bettington, C.M.G., to be actg. Col. (without pay and allowances) whilst employed as Col. from (S.O.); Feb. 3.

Capts. to be Capts. (Grade A.), from (Ad.) :—A. B. Davies; April 1, 1918 (substituted for notification in *Gazette* Dec. 24, 1918). B. H. Brodie; Sept. 26, 1918.

Capt. W. H. Sharpe to be Capt. (Grade B.), from K.B.); Jan. 26.

To be actg. Capts. whilst employed as Capts. (Grade A.) :—Sec. Lieut. (Hon. Lieut.) (actg. Lieut.) D. L. Hollis, Lieut. J. D. Whiteman; Oct. 1, 1918.

To be actg. Capts. whilst employed as Capts. (Grade B.) :—Lieut. A. W. Payne (from Sept. 1, 1918, to Jan. 10). Sec. Lieut. F. G. Murray; Feb. 18.

V. P. Turner (Lieut., Australian Flying Corps) is granted a temp. commn. as Lieut. (Grade A); July 24, 1918.

Lieuts. to be Lieuts. (Grade A.), from (Ad.) :—N. H. Mackrow; Aug. 18, 1918. (Hon. Capt.) C. D. Smart, M.C.; Feb. 10.

Lieuts. to be Lieuts. (Grade B), from (A.) :—M. P. Lewis; Dec. 6, 1918. S. D. Dennis; March 10.

Sec. Lieut. R. M. Duke to be actg. Lieut. whilst employed as Lieut. (Grade A.); Oct. 1, 1918.

Sec. Lieut. R. M. Brown to be Lieut. (without pay and allowances of that rank); Sept. 16, 1918.

Sec. Lieut. (actg. Lieut.) H. S. G. Jamieson to be Lieut.; Sept. 23, 1918.

Sec. Lieuts. to be actg. Lieuts. while employed as Lieuts. (Grade B) :—(Hon. Lieut.) N. W. Walmsley, M.C., from (O.); July 20, 1918 (substituted for notification in *Gazette* Dec. 17, 1918). W. H. Saunders; Dec. 20, 1918.

Sec. Lieuts. to be Sec. Lieuts. (Grade A.), from (Ad.) :—A. J. Brown, M.C.; Sept. 1, 1918. M. Worms; Oct. 25, 1918. W. C. Brown; Feb. 8. H. F. Hickey; Feb. 10 (substituted for the notification in *Gazette* of March 25).

H. Marsden (Sec. Lieut., Manch. R., T.F.) is granted a temp. commn. as Sec. Lieut. (Grade B); Sept. 19, 1918 (substituted for the notification in *Gazette* of Jan. 7).

Then follow the names of 71 officers who are transfd. to the Unemployed List under various dates.

The initials of Sec. Lieut. (Hon. Lieut.) (actg. Lieut.) W. J. G. Barnes are as now described, and not as stated in *Gazette* July 9, 1918.

The surname of Sec. Lieut. (Hon. Lieut.) (actg. Capt.) B. L. Blomley) is as now described, and not Bromley, as stated in *Gazette* March 4.

The notifications in *Gazette* March 7 concerning the following Sec. Lieuts. are cancelled :—H. S. G. Jamieson, T. I. Grimes.

Medical Branch

W. Tyrrell, D.S.O., M.C. (Capt., actg. Lieut.-Col., R.A.M.C.) is granted a temp. commn. as Lieut.-Col.; Nov. 22, 1918, with seniority from April 1, 1918. Capt. C. F. A. Hereford to be Maj.; Dec. 30, 1918.

The following are granted temp. commns. as Lieuts. :—R. H. Parry, R. I. Rhys; April 7.

The following are transfd. to Unemployed List :—Capt. T. B. Dixon; Feb. 3. Capt. P. W. McKeag; Feb. 28. Capt. D. Guthrie; March 8. Capt. S. W. Fisher; March 25. Capt. W. F. Jones; March 27. Lieu. E. L. Bunting, Capt. A. G. H. Smart, M.B.; March 28.

The initials of Capt. J. P. I. Harty are as now described, and not as stated in the *Gazette* of March 28.

The notification in the *Gazette* of Nov. 26, 1918, concerning Capt. R. D. Neagle is cancelled.

Medical (Administrative) Branch

Capt. H. R. B. Hull to be actg. Maj. whilst specially employed; Nov. 18, 1918.

Chaplains' Branch

Capt. G. B. Allen, M.A., is transfd. to Unemployed List; Jan. 5 (substituted for notification in *Gazette* March 4).

Memoranda

Lieut.-Col. (actg. Brig.-Genl.) G. Livingston, C.M.G., is granted the hon. rank of Brig.-Genl.; Feb. 14.

The following Capts. are confirmed in the rank of Capts. :—P. B. Silk, A. W. Williams, D.F.C., W. F. Cleghorn, D.F.C., A. T. Barker, D.F.C., N. Grabowsky, A.F.C., A. M. Harding, V. E. Sieveking, D.S.C., E. R. Barker, D.S.C., W. O. F. Harding, K. G. Boyd, S. E. Ball, D.F.C., M. Hunter, W. H. Sharpe, B. H. Sisson, D. C. Page, D. C. Wood, W. L. Anderson, D.S.C., L. J. R. Blunt.

E. G. Knox (Capt., Aus. Flying Corps) is granted a temp. commn. as Capt.; Oct. 11, 1918.

Sec. Lieut. B. Tamiriantz to take rank and precedence as if his appointment as Sec. Lieut. bore date Feb. 28.

The following Hon. Lieuts. relinquish their commns. on ceasing to be employed :—B. J. Samuels, H. E. White; March 16.

The following are transfd. to Unemployed List, from (S.O.) :—Maj. (actg. Lieut.-Col.) R. W. Roylance; Jan. 27. Capt. (actg. Maj.) H. F. F. Birch (R.A.S.C.); Jan. 28. Maj. C. R. Andrews, M.B.E.; Feb. 1. Capt. H. E. Parker; Feb. 5. Capt. G. Elliott-Lockhart; March 8. Lieut. (actg. Capt.) E. L. Hyde; March 29. Lieut. (actg. Capt.) R. E. Johnson; March 31. Capt. (actg. Maj.) A. Murray; April 1. Capt. (actg. Maj.) S. C. Raffles, O.B.E. (R. Welsh Fus.); April 9.

London Gazette, April 11

The following temporary appointments are made at the Air Ministry :—

Staff Officer, 1st Class.—(T.)—Lieut.-Col. R. W. Hogarth; April 1, 1918.

Staff Officer, 3rd Class.—(P.)—Lieut. (actg. Capt.) E. E. Colquhoun, M.B.E., and to retain the actg. rank of Capt. whilst so employed; March 17.

The following temporary appointments are made :—

Staff Officer, 2nd Class.—(Q.)—Lieut. (actg. Capt.) J. S. Goggin, and to be actg. Maj. whilst so employed; Jan. 28.

Staff Officer, 3rd Class.—(Q.)—Sec. Lieut. (Hon. Lieut.) (actg. Lieut.) J. A. Allen, and to be actg. Capt. whilst so employed; Jan. 28.

Air Attaché.—Maj. (actg. Lieut.-Col.) Sir N. R. A. D. Leslie, Bt., C.B.E., and to retain the actg. rank of Lieut.-Col. whilst so employed; Nov. 30, 1918.

Flying Branch

Lieut.-Col. (actg. Col.) P. B. Joubert de la Ferte, C.M.G., D.S.O., to be Lieut.-Col. (A.), and relinquishes the actg. rank of Col.; Mar. 4.

Lieut. W. R. S. Humphreys to be Lieut. (A.), from (T.); Feb. 22.

Sec. Lieuts. to be Lieuts. :—(Hon. Capt.) J. Macfarlane, and to retain his hon. rank, E. Nordberg, J. P. Carruthers, Hon. Lieut.) D. R. Sharman

April 2, 1918. F. J. Walsh; April 12, 1918. (Hon. Lieut.) J. C. Alderton; April 24, 1918. (Hon. Lieut.) J. C. F. Wilkinson, M.C.; April 27, 1918. (Hon. Lieut.) H. W. Hollands; May 3, 1918. (Hon. Lieut.) C. H. N. Ashlin; May 7, 1918. (Hon. Capt.) G. S. Grant, and to retain his hon. rank, (Hon. Lieut.) J. C. Behord; May 10, 1918. (Hon. Lieut.) A. J. Thomas; May 11, 1918. (Hon. Lieut.) J. Glen; May 17, 1918. (Hon. Capt.) J. Hewitt, and to retain his hon. rank; May 19, 1918. (Hon. Lieut.) R. H. Hampton; May 21, 1918. (Hon. Lieut.) R. N. Haile; May 24, 1918. J. S. H. Willis; May 29, 1918. (Hon. Lieut.) (actg. Lieut.) H. S. Starkey; May 30, 1918. A. L. Jordan; June 6, 1918. A. M. Pearson, (Hon. Lieut.) H. S. Notley; June 15, 1918. (Hon. Lieut.) E. St. H. Davies; June 16, 1918. W. H. Thompson; June 18, 1918. (Hon. Lieut.) H. G. Strange; June 22, 1918. W. W. Mackinlay; July 3, 1918. F. S. Smith; July 14, 1918. (Hon. Lieut.) E. L. Trower; Aug. 22, 1918. N. H. Jay; Aug. 28, 1918. S. J. E. Callcott, T. V. Preedy; Sept. 1, 1918. (Hon. Capt.) D. S. Cumberlege, and to retain his hon. rank; Sept. 2, 1918. (Hon. Lieut.) E. W. Smyth-Pigott, M.C.; Sept. 9, 1918. (Hon. Lieut.) H. A. L. Pattison; Sept. 11, 1918. (Hon. Lieut.) H. Beckett; Sept. 25, 1918. T. R. G. Cooke; Sept. 28, 1918. A. R. Turner, D. C. Simpson; Sept. 29, 1918. (Hon. Lieut.) F. J. Hansell; Oct. 1, 1918. (Hon. Lieut.) H. L. H. Tate; Oct. 4, 1918. (Hon. Lieut.) C. J. Swatbridge; Oct. 5, 1918. F. Heath, R. M. Fletcher; Oct. 9, 1918. J. B. Fletcher; Oct. 11, 1918. P. R. Ambrose; Oct. 21, 1918. (Hon. Lieut.) J. H. McKellar; Oct. 22, 1918. H. M. Smith, J. H. Ball; Oct. 20, 1918. R. T. Symond, M.C., F. S. Tooley, M.C.; Nov. 1, 1918. A. E. Baxter; Nov. 10, 1918. R. P. Greey, S. G. Cockburn, J. G. Angus; Nov. 30, 1918. W. T. Barnes, P. H. Dixon, M.M.; Dec. 10, 1918. H. Haywood, J. R. Wliams; Dec. 27, 1918. F. A. Garwood, H. Laycock; Dec. 27, 1918. (Hon. Lieut.) M. W. Clark; Jan. 1. G. D. V. Russell, A. B. Fee; Jan. 5. R. S. Johnston; Jan. 19. J. T. Thursfield, T. M. Cornish, L. C. Spaven, D. E. Buckland, C. T. Perrins; Feb. 1. R. M. Campbell, J. Erskine, G. S. Daniel; Feb. 2. W. E. L. Courtney; Feb. 12. H. Vanstone; Feb. 25. S. R. Payne; Feb. 28. J. D. McKeogh, C. H. Rice, B. G. Bowen, J. F. Kidd, F. A. D. Vaughan, J. L. Jones, J. Russell, J. J. Birkinshaw, (Hon. Lieut.) E. G. Lunn, R. K. Wilson, A. W. Clark, R. L. Paine, L. G. Speck, C. C. S. Preston, A. Miller, W. B. Walker, D.F.C., A. C. Weekes; March 1. C. H. Clayton; March 2. R. C. E. Vernede; March 3. H. T. Ayres; March 12. J. W. Page; March 13. E. A. Westall; March 17. A. H. Aitken; March 18. (Hon. Lieut.) G. P. Blake, T. E. Gohl, E. A. Seymour; March 19. T. H. Forrest, G. L. Rutherford; March 23. L. Clark, H. A. Pike; March 25. W. Allen, A. W. Day, E. P. Hulme, L. G. Bullock, P. B. Spivey, E. P. W. Dyke, J. N. Gladdish, J. W. Patterson, C. Kipling, L. R. G. Langmead, J. Stewart, A. W. Parr, B. E. Harmer, E. P. Blackmore, H. J. Bristoll, S. Harvey, G. R. Barker, J. N. Ogilvie; March 26. L. A. Wykes, J. V. Lewis, H. S. Basford, J. Morton, T. W. Sleigh; March 27. F. R. Keen; March 28. R. C. Wackett; Mar. 29. W. S. Spark; Mar. 30. H. W. Minish; April 1.

The following relinquish their commns. on ceasing to be employed:—Lieut. E. W. J. Cass (Lieut., E. Surr. R.); Feb. 11. Sec. Lieut. (Hon. Lieut.) W. S. Ross (Lieut., Sco. Rif.); Feb. 15. Sec. Lieut. F. V. Preston (Sec. Lieut., W. Yorks R., T.F.); March 11. Lieut. P. W. Leycester (Lieut., (actg. Capt.) R.A.S.C.); March 14.

(Then follow the names of 97 officers who are transfd. to the Unemployed List under various dates).

The following Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank:—J. H. Acton (contracted on active service); J. F. V. Atkinson (contracted on active service), K. L. Golding, L. H. Phillips (contracted on active service); April 12.

Lieut. W. A. Hunter (K.O.Y.L. Inf.) relinquishes his commn. on account of ill-health; April 12.

Sec. Lieut. (Hon. Lieut.) H. V. Drew relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain the rank of Lieut.; April 12.

The following Sec. Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank:—S. Bennett; July 13, 1918 (substituted for notification in *Gazette* of July 12, 1918). V. H. Barnfield (contracted on active service). J. H. Hay (contracted on active service), E. A. Homer, W. T. Leonard (contracted on active service), T. Powers, W. L. Vennell, C. Ware (contracted on active service); April 12.

Sec. Lieut. J. N. Holman resigns his commn.; April 12.

The Christian names of Capt. O. A. Westendarp are as now described, and not as stated in *Gazettes* of Jan. 17 and March 28.

The Christian names of Sec. Lieut. William George Edwards are as now described, and not as stated in *Gazette* of Aug. 6, 1918.

The surname of Lieut. H. S. Davidson is as now described, and not Davison, as stated in *Gazette* of March 11.

The initials of Sec. Lieut. H. C. Murray are as now described, and not as stated in *Gazette* of March 18.

Sec. Lieut. W. Woodstack is antedated in his appointment as Sec. Lieut. (Obs. Officer); May 22, 1918.

The notification in *Gazette* of March 25 concerning Lieut. S. H. B. Emms is cancelled.

The notification in *Gazette* of Jan. 15 concerning Sec. Lieut. A. R. Giroux is cancelled.

The notification in *Gazette* of April 1 concerning Sec. Lieut. (Hon. Lieut.) D. C. Lockwood is cancelled.

The notification in *Gazette* of Feb. 14 concerning Lieut. G. M. Dean is cancelled.

The notification in *Gazette* of Feb. 4 concerning Lieut. A. Buckley is cancelled.

The notification in *Gazette* of Feb. 14 concerning Lieut. A. A. Campbell is cancelled.

The notification in *Gazette* of March 18 concerning Sec. Lieut. N. C. B. Carrick is cancelled.

The notification in *Gazette* of March 18 concerning Sec. Lieut. (Hon. Lieut.) C. L. Childs is cancelled.

Administrative Branch

The following are granted temp. commns. as Capts.:—W. L. Blake (Capt., Norf. R.); T. N. Flatt (Capt., Norf. R.); W. J. May (Capt., Camb. R.); April 1, 1918.

Lieut. R. J. L. Gerard to be actg. Capt. while employed as Capt.; April 1.

The following are granted temp. commns. as Lieuts.:—F. H. Bushell (Lieut., Essex R.), W. H. Peat (Lieut., Ches. R.); April 1, 1918. A. C. Corbetta (Temp. Lieut., Gen. List); July 1, 1918, seniority April 1, 1918.

Lieuts. (A.) to be Lieuts.:—(Actg. Capt.) D. H. Robertson; Oct. 30, 1918, and relinquishes actg. rank of Capt. H. J. Pownall; Nov. 1, 1918. R. A. Young; Nov. 6, 1918. S. H. Wrinch; Dec. 13, 1918. R. Caldecott, F. W. Dogherty; Dec. 16, 1918. F. W. Mundy; Feb. 3. C. J. Stansfield; March 14.

Lieut. E. R. Brown to be Lieut., from (K.B.); Jan. 1.

Lieuts. (O.) to be Lieuts.:—J. A. Manners-Smith; Dec. 16, 1918. F. V. Carpenter; Dec. 18, 1918. J. W. W. Tregale; Dec. 31, 1918. D. W. Orr; Jan. 18. A. W. Rogers, M.M.; Feb. 28. J. Chatterton, M.C.; March 4.

Sec. Lieuts. to be Lieuts:—(Hon. Lieut.) (actg. Lieut.) T. Hobson; April 2, 1918. (Hon. Capt.) (actg. Lieut.) H. A. de F. Furber; July 1, 1918, and to retain his hon. rank. (Actg. Lieut.) W. H. Nankivell; July 25, 1918. J. M. Adams; Sept. 1, 1918. (Actg. Lieut.) G. E. Tune; Sept. 28, 1918. (Hon. Lieut.) A. R. Barnes; Sept. 30, 1918. (Actg. Lieut.) W. H. Botterill; Oct. 5, 1918. A. E. T. Robinson; Oct. 26, 1918. V. W. Gill; Nov. 8, 1918. I. M. Moffat; Nov. 27, 1918. (Actg. Lieut.) M. Poole-Conner; Nov. 30, 1918. A. E. Peel; Dec. 21, 1918. W. Hopps; Dec. 22, 1918. H. E. Gridley; Feb. 5. F. E. Shersby; Feb. 16. C. Lyons; March 8. L. Singer; March 16.

Sec. Lieuts. to be Sec. Lieuts., from (A.):—H. C. Mitchell; Jan. 3. A. E. Overton; Jan. 8, and to be Hon. Lieut. R. J. Tomson; Jan. 9. R. Logan; March 19. W. V. Ryan; March 21.

Sec. Lieuts. to be Sec. Lieuts., from (A. and S.):—G. J. E. Boyd; Jan. 5. R. M. Mulrihill; March 1. C. E. Watson; March 21.

Sec. Lieuts. to be Sec. Lieuts., from (O.):—L. Eteson; Nov. 25, 1918. S. R. Payne; Nov. 29, 1918. A. Taylor; Dec. 10, 1918. S. A. Barnes; Jan. 6. F. H. Sibley; Jan. 20, and to be Hon. Lieut. W. I. E. Lane, M.C.; Jan. 24. D. F. Harrison; Feb. 9. H. Ricketts; Feb. 13. B. Hurdus, G. E. Rochester, E. A. Seal; March 18. M. C. Sexton; March 26, and to be Hon. Lieut. Sec. Lieut. J. H. Drayton (late Gen. List, R.F.C., on prob.) is confirmed in his rank as Sec. Lieut.; March 21.

The following relinquish their commns. on ceasing to be employed: Lieut. A. G. Heap (Lieut., L'pool R.); Nov. 3, 1918. Sec. Lieut. F. A. Pritchard (Sec. Lieut., Ches. R.); March 17.

(Then follow the names of 19 officers who are transfd. to the Unemployed List under various dates.)

The following Lieuts. (actg. Capts.) relinquish their commns. on account of ill-health contracted on active service, and are permitted to retain the rank of Capt.:—S. I. Chapman, (Hon. Capt.) C. W. Wright; April 12.

The following Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank:—J. R. Hett (R.F.A.), W. H. Glaser, H. I. Turner (contracted on active service); April 12.

The following Sec. Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank:—G. Elliott (caused by wounds); E. Holt; April 12.

The date of appointment of Lieut. E. S. C. Brooks as actg. Capt. is Feb. 1, and not as stated on page 3021 of the *Gazette* of March 4.

The surname of R. S. Maitland-Edwards is as now described, and not as stated in the *Gazette* of March 7.

The notification in the *Gazette* of March 7 concerning Lieut. D. H. Robinson, A.F.C., is cancelled.

Technical Branch

Lieut. R. H. McLeod to be Lieut. (Grade A) from (A.); July 16, 1918.

Sec. Lieuts. to be Lieuts.:—(Hon. Lieut.) (actg. Lieut.) E. A. Gulson, (Hon. Lieut.) (actg. Capt.) H. C. Bishop and to retain his actg. rank; April 2, 1918. (Actg. Lieut.) R. G. Shackel; April 13, 1918. (Actg. Lieut.) E. W. Brooks; June 8, 1918. (Actg. Lieut.) S. Beeby; Aug. 12, 1918. (Actg. Lieut.) J. S. Done; Sept. 14, 1918. (Actg. Capt.) L. A. Hooper; Oct. 8, 1918, and to retain his actg. rank. (Actg. Lieut.) J. D. Fairbairn; Oct. 27, 1918. (Actg. Lieut.) C. W. B. Tubbs; Dec. 1, 1918. (Actg. Maj.) R. B. Stephenson; Dec. 18, 1918, and to retain his actg. rank. (Actg. Capt.) C. G. Stevens; Jan. 19, and to retain his actg. rank. (Actg. Capt.) C. H. Quelch; Jan. 29, and to retain his actg. rank. (Actg. Lieut.) J. F. Clark; Jan. 31.

Sec. Lieuts. to be Lieuts., without pay and allowances of that rank:—(Hon. Lieut.) J. Lundon, (Hon. Lieut.) E. W. Hallam, (Hon. Capt.) H. Gardiner, and to retain his hon. rank, N. E. Corbishley, (Hon. Capt.) G. M. Nobbs, and to retain his hon. rank, (Hon. Lieut.) A. W. Furbank, E. P. Proud, (Hon. Lieut.) R. F. Tindall, G. W. G. Tucker, (Hon. Lieut.) M. A. Shepstone, N. Pellew, (Hon. Lieut.) J. W. Bradford; April 2, 1918. S. G. Elliot-Smith; April 14, 1918. (Hon. Capt.) E. H. Walter, and to retain his hon. rank, (Hon. Lieut.) B. Hesketh; April 23, 1918. A. R. Butler; May 4, 1918. (Hon. Lieut.) J. E. Sierra, C. Groves, F. M. Thomas; May 5, 1918. F. B. Palmer, M.C.; May 13, 1918. (Hon. Lieut.) J. T. M. Hill; June 16, 1918. (Hon. Lieut.) C. H. Habrow; June 18, 1918. (Hon. Lieut.) H. B. Lee, M.C.; July 26, 1918. A. McCulloch; Aug. 9, 1918. L. McLauchlan; Aug. 10, 1918. J. S. V. Stephen; Aug. 13, 1918. J. K. Shrimpton; Aug. 19, 1918. W. F. Thrutchley; Sept. 11, 1918. F. H. Alder; Sept. 12, 1918. E. A. Moran-Smith; Sept. 14, 1918. H. W. Sharman; Oct. 26, 1918. (Hon. Lieut.) H. J. Dixon; Nov. 9, 1918. P. E. Towler; Nov. 24, 1918. E. R. Blount, R. U. Nash-Taylor; Dec. 1, 1918. T. Willis; Dec. 30, 1918. (Hon. Lieut.) E. J. Leech; Jan. 1. R. E. H. Heenan; Jan. 16. J. S. Suckling; Jan. 19. C. H. Chadwick, J. C. Shakeshaft; Jan. 31. V. H. C. Gayford; Feb. 7. E. Harrison; Feb. 12. C. G. Foster; Feb. 21. R. T. B. Wynn, C. W. Triggs, G. Glen, W. H. Short; Feb. 24. M. G. Fountain; Feb. 28. G. R. Hanson, W. C. Farley; March 1. W. E. French; March 2. W. H. Fearnsides; March 5. F. S. Stokes, A. Campbell, A. Jennings, F. T. Holmes, F. O. Browson; March 8. A. Ledger; March 10. H. A. Creswell; March 18. J. G. Tennant; March 20. C. J. Ashdown, F. G. Rison; March 21. F. L. Barnett, S. G. Newport, H. S. C. Cann, D. H. Fenner, J. H. Hunter, C. F. Lane, J. W. Power; March 24.

Sec. Lieut. L. Wardle-Donald to be Lieut., from (Ad.); Ang. 9, 1918 (substituted for notification in *Gazette* Aug. 30, 1918).

Sec. Lieut. G. A. F. Gibson to be Sec. Lieut., Grade "A," from (Ad.); Dec. 2, 1918.

Lieut. A. J. Dale (R.N.) relinquishes his commn. on ceasing to be employed; March 22.

(Then follow the names of 33 officers who are transfd. to Unemployed List under various dates.)

Sec. Lieut. P. O. Patterson relinquishes his commn. on account of ill-health, and is permitted to retain his rank; April 12.

The initial of H. Cox is as now described, and not E., as stated in *Gazette* of April 4.

The notification in *Gazette* of March 18, concerning Lieut. F. A. Roberts is cancelled.

The notification in *Gazette* of April 1 concerning Sec. Lieut. H. Linfield is cancelled.

Medical Branch

Capt. J. S. Dockrill (R.A.M.C.) is granted a temp. commn. as Capt.; Oct. 1, 1918, with seniority from April 1, 1918.

N. S. Gilchrist, O.B.E. (Temp. Capt., R.A.M.C.), is granted a temp. commn. as Capt.; Oct. 1, 1918, with seniority from April 1, 1918.

Lieut.-Col. W. H. Pope (R.N.) relinquishes his commn. on ceasing to be employed; April 14.

The following are transfd. to Unemployed List:—Capt. A. B. Lindsay; Feb. 24. Capt. C. L. Birmingham, M.D.; March 1. Capt. C. W. W. James; March 4. Capt. C. F. Hereford; March 18.

The notification in *Gazette* of April 1 concerning Capt. E. W. W. Jones is cancelled.

Dental Branch

Sec. Lieut. D. Campbell is transfd. to Unemployed List; March 28.

Memoranda

Sec. Lieut. (Hon. Lieut.) R. W. Monro is granted the hon. rank of Capt.; June 7, 1918.

Sec. Lieut. W. G. Edwards to take rank and precedence as if his appointment as Sec. Lieut. bore date Jan. 24.

Temp. Hon. Lieut. R. H. Harnett relinquishes his commn. on ceasing to be employed; March 1.

The following are transfd. to Unemployed List from (S.O.):—Lieut. (actg Capt.) E. A. Mayner; Mar. 31. Lieut. (actg. Capt.) H. H. Harries; April 1.

SIDE-WINDS

IT is announced that Mr. L. Coatalen, chief engineer and joint managing director of the Sunbeam Motor Car Co., Ltd., Wolverhampton, will in the immediate future concentrate his attention solely on the design of cars, aeroplane engines, airship engines and gear, and motor-boat engines. On account of the increase in the size of the works and volume of business, Mr. Coatalen tendered his resignation as joint managing director to the board of directors, who have agreed with his views that it is wise to dissociate the combined duties of joint managing director and chief engineer, it being found practically impossible for one individual adequately to cover both functions in a works so large as that of the Sunbeam company. Mr. Coatalen will, therefore, become chief engineer of the company, devoting the whole of his time, and being responsible for the design of the Sunbeam company's productions, retaining, of course, his seat on the board of directors. Mr. W. M. Iliff, who was the joint managing director with Mr. Coatalen, now becomes sole managing director.

ON April 15 Mr. Coatalen sails for America to study the conditions of motor manufacture and production in the United States, and he will probably be in charge of the brace of Sunbeam racing cars entered in the international Indianapolis race to be held on May 31, which are to be driven by Jean Chassagne and Dario Resta.

FOLLOWING on an arrangement concluded with the Society of British Aircraft Constructors, the Aero Committee of the Society of Motor Manufacturers and Traders has been abolished.

THE design for the casket to be presented by the City Corporation to the Prince of Wales, on the occasion of His Royal Highness taking up the Freedom by patrimony, has now been accepted. The casket is to be of 18-carat gold, the ornamentation consisting of the Prince's arms, the arms of the City, the national emblems, the Welsh dragon, and views of the Guildhall, Mansion House, etc.—all in enamel. The gift, which will be an artistic example of the goldsmiths' art, has been designed and will be executed by the Goldsmiths' and Silversmiths' Company, Ltd., 112, Regent Street, London, W. 1.

BY way of commemorating the great success achieved by the "Austin Twenty" car, the staff of the Austin company held a dance at the Grosvenor Rooms, Birmingham, on the 8th inst. Every item was carried through in the happiest style, and smiling faces on every side testified that all present were enjoying themselves thoroughly. It may be recalled that the post-War policy of this well-known firm is to produce and place upon the market a standard chassis ranking among the highest grades in British cars, but at a moderate price.

"ASCOL HOUSE" announces two new outposts have been opened. One at 237, West George Street, Glasgow, is in charge of Mr. H. S. Maxwell, while the other at 4, Central Exchange Buildings, Newcastle-on-Tyne, is under the watchful care of Mr. J. C. Fildew. "Ascol House" now has its branch establishments in Birmingham, Leeds, Manchester, Glasgow and Newcastle, whilst the representatives for South Wales and the East Coast are fitting up offices in Cardiff and Norwich respectively, and in due course arrangements will be made to have stocks ready at all branches for customers' immediate requirements.

WHICH reminds us that owing to the large demand for *Ascol News*, it will be published monthly in the future. The issue for May promises to be brimful of good things. On the lighter side there will be "A Seance at 'Ascol House'" as described by Mr. Douglas W. Thorburn in his inimitable style.

IT is announced that Mr. Chas. W. Turner has been appointed general manager of the National Benzole Co., Ltd. Mr. Turner, who was formerly with the Vacuum Oil Co., has served, during the War, as section director in charge of the railway and distribution branch of the Explosives Department.

FROM Messrs. Ruston and Hornsby, Ltd., of Lincoln, comes a souvenir of the 1,000th aeroplane turned out by the firm. This has two views of the actual machine—a Sopwith Camel—in colours, while there are a number of interesting photos. taken on the occasion of the visit of the King and Queen. It is not generally known that the late Lieut. W. Leefe Robinson, V.C., was flying a Ruston-built machine—the fourth turned out by the firm—when he brought down the German airship at Cuffley on October 3, 1916, and this incident forms the subject of another coloured illustration.

LIEUT.-COL. L. SADLER, O.B.E., late technical commandant of the R.A.F. School of Technical Training, Wendover, has now been demobilised, and has rejoined the staff of Messrs. H. M. Hobson, Ltd., as works engineer.

IT has been announced by the Board of Trade that the prohibition of magnetos is to be maintained, and licences to import are to be granted only in very exceptional circumstances. The importation of motor-vehicles (including motor-bicycles) and accessories therefor is to be restricted till September 1, 1919, to 50 per cent. of 1913 imports, to be licensed in proportionate monthly quantities. The importation of forgings and castings for motor-vehicles is to be similarly restricted and licensed, and during the same period. Spare parts are to be admitted freely under licence for renewal purposes only by way of repair to foreign-made vehicles already on the road. The prohibition on auto-scooters is to be maintained.

LIEUT.-COL. T. B. BARRINGTON, who for six years before the War had been on the engineering and designing staff of Rolls-Royce, Ltd., has now returned to civilian life, and accepted the position of chief assistant engineer to Rolls-Royce, Ltd. From March, 1915, he has been on War service, firstly in connection with the aero engine department of the Admiralty, and secondly, as officer in charge of aircraft engines immediately under the head of the technical side of aircraft. The other principal officers of the engineering department of Rolls-Royce serving under Mr. F. Henry Royce, the engineer-in-chief, are Mr. Day and Mr. Elliot, chiefs of designing staff; Mr. Bailey and Mr. Olley, chief production draughtsmen; Mr. Nadin and Mr. Haldenby, equipment engineers; Mr. Hall, metallurgical chemist.

The "Guardian Angel" Parachutes

THE efficiency of the "Guardian Angel" parachutes has been so amply demonstrated that it seems incredible that its inventor, Mr. Everard R. Calthrop, should have met with so much obstruction in its development. This is strikingly brought out in the G.A.P. book A, which has just been published by E. R. Calthrop Aerial Patents, Ltd., in which are given details of several demonstrations as well as a large number of photographs showing the various stages of the opening of the parachute in actual use. A detailed description of the parachute is also given, together with diagrams showing the system of operation. There is also a list of different types of "Guardian Angel" parachutes and accessory equipment. The book, which is published at half-a-crown, gives a deal of useful information as to what has been attempted and accomplished in the solution of a problem of great difficulty and vital importance, not only to flying officers, but to all travellers by air.

H.P.'s for China

IT may be recalled that some months ago it was announced that Handley-Page machines were to be utilised for conveying to the interior of China material for the wireless installations which it was proposed to erect there, and we understand that the Chinese Government has just concluded the necessary agreements. Messrs. Handley Page, Ltd., have just received, through their agents, the Pekin Syndicate, a large contract for the supply of machines and the necessary organisation to the Chinese Ministry of Communications. The first machines sent out will be of the twin-engine biplane type adapted to seat ten passengers and to carry 1,800 lb. of cargo. Experts and pilots will be supplied, and the construction of aerodromes will be undertaken.

Aeroplanes for Czecho-Slovaks

A BRIEF message from New York states that 25 American aeroplanes have been sold to the Czecho-Slovak army.

U.S. Orders More 'Planes

THE United States War Department has stated that a contract has been signed with the Curtiss Aeroplane and Motor Corporation to build 4,608 Curtiss aeroplanes. Evidently the United States Air Service is not closing down just yet.

RESETTLEMENT

Resettlement of R.A.F. Personnel

THERE are many officers and men of the R.A.F. who are demobilised or are about to be demobilised.

In order to assist those who are undecided or are seeking advice as to their prospects in civil life, the Editor has arranged for an expert, with wide experience of service, industrial and educational conditions, to give advice to those who may solicit it through the medium of this Journal.

Applications, which must be in writing, should be marked *Resettlement*, and addressed to the Editor, FLIGHT, 36, Great Queen Street, Kingsway, W.C. 2. They will be dealt with in these columns, as far as possible, in rotation.

J. R. K., S.W. 5.—To be a successful designer of aircraft a thorough knowledge of mechanical engineering and theory of structures is essential as a foundation. This knowledge is most readily acquired at an engineering college during a period varying from two to four years. You will be best advised to go through such a course and not seek employment in a drawing office with your present lack of training and skill. You should avail yourself of the opportunities afforded by the Appointments Department of the Ministry of Labour for a course of aeronautical engineering at some approved college or University.

G. O. T., Huddersfield.—The scheme outlined in your letter is very sound. Too few realise that aeronautical engineering requires similar studies and courses to those found necessary for other branches of engineering. It will certainly be to your advantage to join the Royal Aeronautical Society. Write to the Secretary, Royal Aeronautical Society, 7, Albemarle Street, Piccadilly, W. 1.

M. R. K., EX-FLIGHT CADET.—With your limited training, we do not consider that there is much prospect of your obtaining employment in the aircraft industry at present. You say you cannot resume your pre-War training, but you should remember that thousands of students, many of whom attained high rank and honours in the Navy, Army or R.A.F. have returned to college to complete their interrupted studies.

H. J. P.—If you are medically fit to finish your apprenticeship you will be best advised to do so. Otherwise we suggest that you seek an appointment as Stores Clerk as you have both technical knowledge and clerical experience.

COMPANY MATTERS

Handley Page, Ltd.

FOUNDED in 1908, and converted into a limited liability company in June, 1909, Handley Page, Ltd., manufacturers of aircraft of all kinds, announces the issue of 500,000 participating preference shares of £1 each at 21*s*. per share Two thousand preference shares at 21*s*. each have already been allotted to the directors as qualification and 498,000 are offered for public subscription. The capital is £650,000, consisting of £150,000 in £1 ordinary and the preference shares now offered. The latter participate in the profits up to 14 per cent. The prospectus states that the company has on hand contracts to a total value of £1,787,000, the unexecuted portion of which amounts to £1,301,000, and additional capital is necessary to meet the increase in the business. The profits for the year ended December 31, 1915, are certified to have amounted to £6,985; 1916, £22,026; 1917, £40,783; and 1918, £224,758 (subject to audit). No debentures (other than debentures to secure advances from the company's bankers) or shares ranking in priority to or *pari passu* with the preference shares can be created without the sanction of a majority of the preference shareholders. It is also stated that Handley Page aeroplanes are ready for immediate use for commercial work, and the company is making arrangements for its representation in almost every important country in the world for the purpose of developing commercial aviation.

NEW COMPANIES REGISTERED

ENNISMORE MOTOR CO., LTD.—Capital £5,000, in £1 shares. Manufacturers and dealers in aeroplanes, airships, etc., motor and aero engines and parts, etc. Solicitors: Simmons and Simmons, 18, Finch Lane, E.C.

FLUXIO WELDING CO., LTD., 5, Rawcliffe Street, South Shore, Blackpool.—Capital £5,000, in £1 shares. Oxy-acetylene, electrical or other welders, etc. First directors: T. A. Cotton, Dr. H. E. Cockcroft and J. P. Schofield.

HENRY MEADOWS, LTD., Carlton Chambers, Lichfield Street, Wolverhampton.—Capital £10,000, in 9,650 "A" shares of £1 each and 1,750 "B" shares of 4*s*. each. Dealers in machinery, motors, aeroplanes, etc. First directors:—C. Holmes, F. S. Hooper, F. Pickering, S. H. Ellard, A. Blackburn, A. Noble.

IMPORTS AND EXPORTS, 1918-1919.

AEROPLANES, airships, balloons and parts thereof (not shown separately before 1910). For 1910 and 1911 figures see "FLIGHT" for January 25, 1912; for 1912 and 1913, see "FLIGHT" for January 17, 1914; for 1914, see "FLIGHT" for January 15, 1915; for 1915, see "FLIGHT" for January 13, 1916; for 1916, see "FLIGHT" for January 11, 1917; for 1917, see "FLIGHT" for January 24, 1918; and for 1918, see "FLIGHT" for January 16, 1919.

	Imports.		Exports.		Re-exportation.	
	1918.	1919.	1918.	1919.	1918.	1919.
	£	£	£	£	£	£
January ...	49,402	555,989	24,765	57,571	—	—
February	51,941	453,822	13,545	57,972	—	—
March ...	47,930	704,424	11,451	72,716	1,000	400
	149,273	1,714,235	49,761	188,259	1,000	400

Aeronautical Patents Published

Abbreviations:—cyl.=cylinder; I.C.=internal combustion; m.=motors.

Applied for in 1915

Published April 17, 1919.

16,013. H. J. CHAPPLE. Sight for anti-aircraft guns.
16,316. E. G. ELIOT. Anti-aircraft guns.
16,391. J. H. MANSELL and R. REDPATH. Sights for anti-aircraft guns.
16,445. BLACKBURN AEROPLANE AND MOTOR CO. and R. BLACKBURN. Aircraft propellers.
16,659. H. M. HILBERY. Anti-aircraft gun-sights.
16,856. Sir A. T. DAWSON and G. T. BUCKHAM. Sight for anti-aircraft guns.
17,141. SAGE AND CO. and E. C. G. ENGLAND. Aircraft parts.
17,385. VICKERS, LTD. and G. H. CHALLENGER. Bullet deflectors for aeroplane propellers.
17,528. H. O. SHORT. Mounting of guns on aircraft.
17,529. H. O. SHORT. Mountings for guns.

Applied for in 1917

The numbers in brackets are those under which the specifications will be printed and abridged, etc.

Published April 17, 1919.

5,574. F. C. V. LAWS. Cameras for use on aircraft. (124,225.)

Applied for in 1918

The numbers in brackets are those under which the specifications will be printed and abridged, etc.

Published April 17, 1919.

4,980. T. F. McDONALD and T. W. NASEBY. Inclination indicator for aircraft. (124,280.)
5,407. I. BURN. Compasses and inclinometers. (124,293.)
5,882. W. G. TARRANT and W. H. BARLING. Landing-skids for aircraft. (124,304.)
7,525. W. J. BULKENS. Speed-indicator for aircraft. (124,318.)
11,384. F. W. CHANNON. Aerial propellers. (124,355.)
12,197. P. SWAN. Aircraft control. (124,363.)

NOTICE TO ADVERTISERS

IN order that "FLIGHT" may continue to be published at the usual time, it is now necessary to close for Press earlier. All Advertisement Copy and Blocks must be delivered at the Offices of "FLIGHT," 36, Great Queen Street, Kingsway, W.C. 2, not later than 12 o'clock on Saturday in each week for the following week's issue.

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Telephone: Gerrard 1828.

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UNITED KINGDOM.	s.	d.	ABROAD.	s.	d.
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6 " " ..	14	1	6 " " ..	16	6
12 " " ..	28	2	12 " " ..	33	0

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